the

tool engineer

MARCH 1957

25th anniversary

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

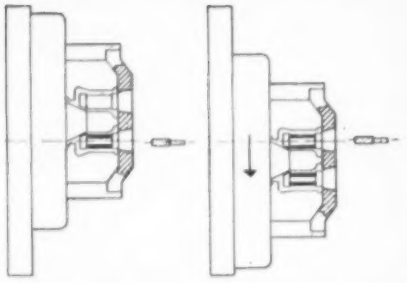
AUTO-INDEXING permits

single chucking for double bore grinding

Manually re-locating a part to grind a *second* bore takes valuable operator time. This time can be saved, in many instances, by the use of an auto-indexing fixture on a Heald Internal Grinder. For example, the Model 271 Size-Matic shown below precision grinds *two* interrupted bores in a universal joint body in a single, fully automatic, 71-second cycle.

The diagrams at right show how both bores of the work are brought in line with the grinding wheel — automatically!

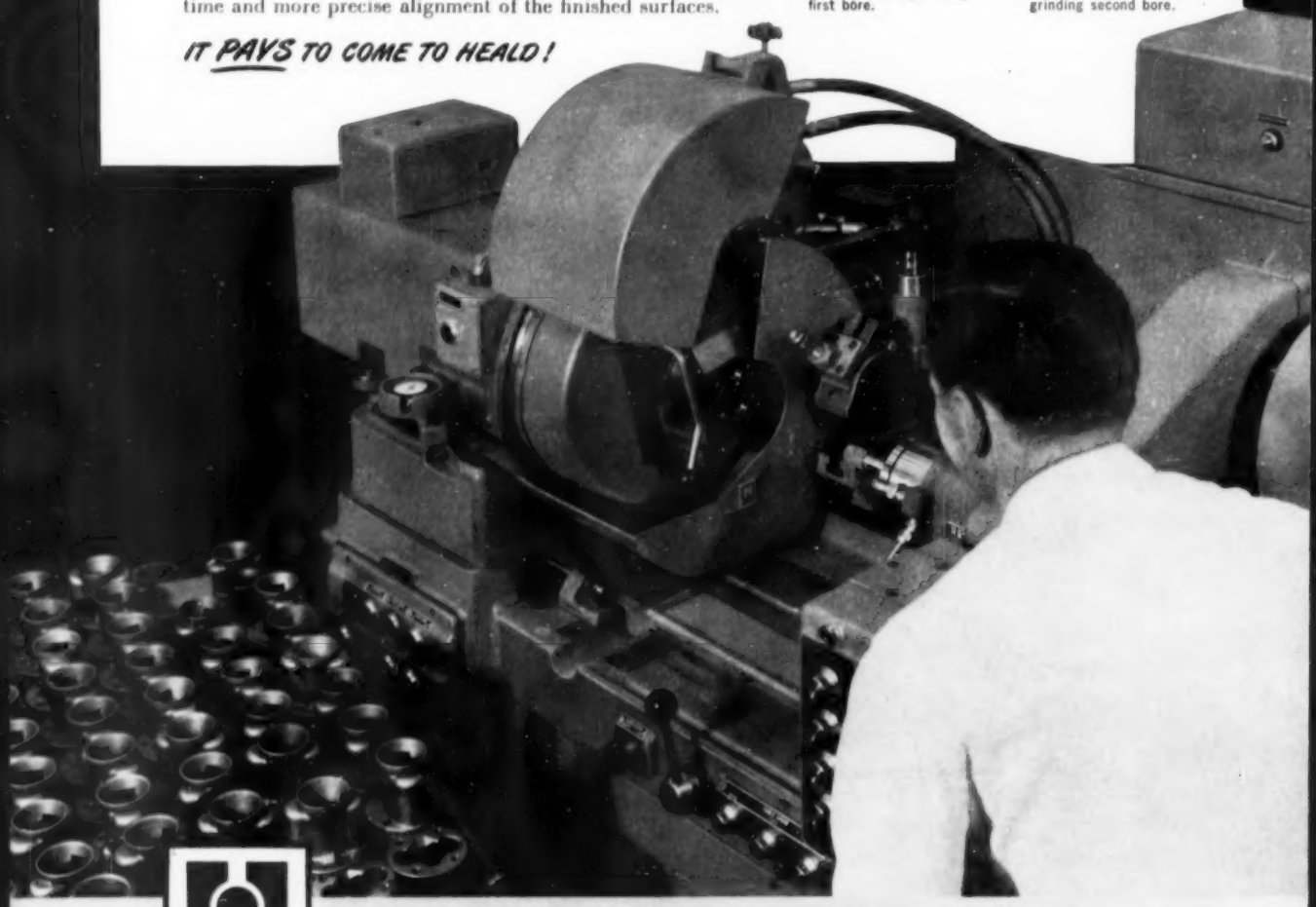
This auto-indexing feature can be used for many two-bore grinding jobs of this type with substantial savings in handling time and more precise alignment of the finished surfaces.



Auto-indexing fixture in position for grinding first bore.

Rotary cross-feed unit indexed to position for grinding second bore.

IT PAYS TO COME TO HEALD!



HEALD

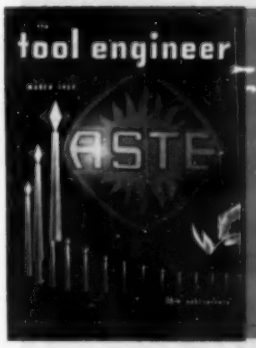
THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

® Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

COVER: Symbolic of the 25 years that have led to ASTE's Silver Anniversary and of the years to come, the hand with the torch is not only lighting birthday candles but is shedding new light on education and progress in production. This issue highlights some footnotes on the past, some current events and a few glances toward the future.



The Tool Engineer

Volume XXXVIII, No. 3 March 1957

TECHNICAL ARTICLES

Silver Anniversary . . . . . By H. C. McMillen 71
Trends in Tool Engineering . . . . . By T. W. Black 73
Gadgets 80
Tooling for the Satellite . . . . . By T. W. Black 83
How To Repair and Modify Plastic Tools . . . . . By Benjamin Sokol 86
Experimenting with Ceramic Applications . . . . . By J. F. Allen 91
Titanium Chips Can Be Broken Easily . . . . . By Jens L. Wennberg 95
Power Roll Forming Cuts Production Costs . . . . . By J. W. Bergman 99
Designed for Production 102
Buckling Limits in Contour Forming (Part 2) . . . . By William W. Wood 105
Tools at Work 114
Cavalcade of Tools . . . . . By Robert B. Douglas 117
How To Mill with Carbides on Older Machines . . . . By Horace Frommelt 122
Engineering and Tooling for Dependability . . . . By Ralph H. Eshelman 125
Machining with Ceramics, and Properties of Bent Tubing (Reference Sheets) 133

ASTE NEWS

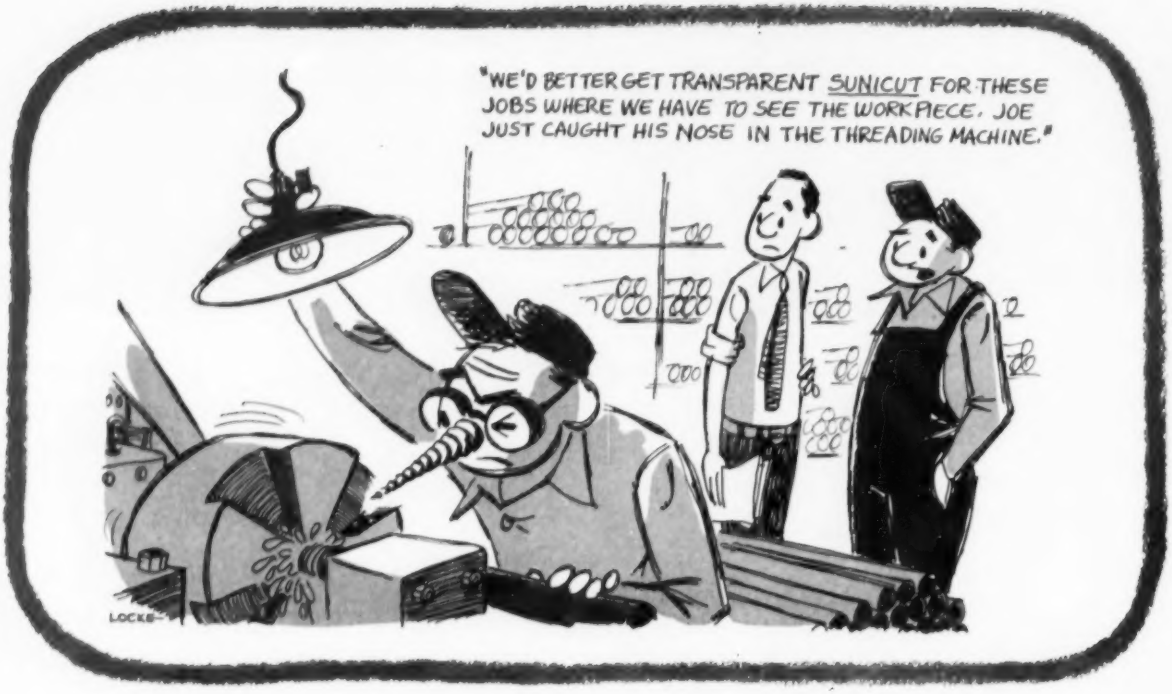
Twenty-fifth Annual Convention 137
ASTE's Silver Anniversary 157
Chapter News and Views 185

DEPARTMENTS

Abstracts of Foreign Literature 263
Field Notes 253
Good Reading 259
Letter from the Editor 3
Men at Work 241
Progress in Production 189
Tech Digests 267
Technical Shorts 249
Tools of Today 195
Trade Literature 244
Who's Meeting—and Where 261
Advertisers' Index 455

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*


"WE'D BETTER GET TRANSPARENT SUNICUT FOR THESE JOBS WHERE WE HAVE TO SEE THE WORKPIECE. JOE JUST CAUGHT HIS NOSE IN THE THREADING MACHINE."
LOCKE

For precision cutting...

TRANSPARENT SUNICUT OILS ASSURE YOU GOOD VISIBILITY, PEAK PRODUCTION

Transparent Sunicut oils assure excellent finish in critical operations at close tolerances. Good visibility speeds production.

Transparent Sunicut® oils, including heavy-duty and dual-purpose oils, are available in many grades to suit your specific needs. They give outstanding results...especially where precision cutting is required.

Their transparency takes the "blinders" from work that needs close watching, permitting close product control, faster production, lower unit cost. Machine operators like Sunicut's "cleanliness." Most important, *transparent Sunicut oils assure you of good finishes.*

For full information about Sunicut cutting oils, call your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-3.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO®

©Sun Oil Company

Harry E. Conrad
Executive Secretary
Allan Ray Putnam
Publishing Manager

Editorial

John W. Greve
Editor
Robert A. Wason
Associate Editor
Ralph H. Eshelman
Associate Editor
Theodore W. Black
Associate Editor
Arthur Colton
Assistant Editor
Dorothy J. Taylor
Assistant Editor
Janet B. Lofting
News Editor
Susanne Olson
Assistant News Editor
Michael Babala
Art Editor
F. Laitia Pierce
Assistant Art Editor

Business

Michael Jakesy
Business Manager
Clarence T. Etter
Advertising Manager
Austin G. Cragg
Eastern Advertising Mgr.
400 Madison Ave.
New York 17, N. Y.
Francis Baldwin
Middle Atlantic Adv. Mgr.
400 Madison Ave.
New York 17, N. Y.
Richard E. Cleary
Ohio Advertising Mgr.
15515 Detroit Ave.
Cleveland 7, Ohio
R. Alan Cobleigh
Michigan Advertising Mgr.
10700 Puritan Ave.
Detroit 38, Mich.
Stanley F. Girard
Western Advertising Mgr.
612 North Michigan Ave.
Chicago 11, Ill.
Robert E. Ahrensdorf
Pacific Coast Adv. Mgr.
5720 Wilshire Blvd.
Los Angeles 36, Calif.
Fay H. LaRoue
Circulation Manager

THE TOOL ENGINEER

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Publication Office:
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription: members $2.00; nonmembers, $4.00; Canada, $4.50, and all other countries, $5.00. Copyright 1957, American Society of Tool Engineers.

The Tool Engineer

25 Years of Progress

Credit for our modern engineering approach to production problems has often been given to Taylor for his original analysis of metal cutting. Also, at the turn of the century, motion analysis was being studied by other pioneers like Gilbreth. Without such groundwork, the progress and developments that followed, especialy those during the past twenty-five years, could not have been attained.

Growth of the American Society of Tool Engineers, now celebrating its 25th anniversary, is closely identified with this progress in production methods. At the time of founding the society, the controversy of group drives vs. individual-motor drives was at its peak. Many authorities predicted that carbides were not practical production tools. Advocates of industrial electronics promised to solve all control problems with the light-sensitive phototube.

Since then, progress has been outstanding. Individual and multi-motor drives are commonplace. Ceramic cutting tools now hold the precarious position previously held by carbides and hope to follow the same path. Electronics are applied freely wherever they are economical. The sensational phototube has taken its place with other useful limit switches. Applying tape-controlled machines, automatic gaging, automatic feeding and automatic ejecting have become usual problems in our progress toward automation. With increased accuracies demanded of machines and more automatic controls with feedback, the newer static-type relays—with their maintenance-free characteristics—may provide the answers to the involved circuitry for automation.

Unquestionably, the past 25-year period has brought to fruition more ideas with practical applications than has any other in history. Two articles in this issue, one by Douglas on historical milestones and the other by Black on outstanding recent achievements, testify to this claim. Members of the society can be justly proud of fostering the principles of progress and providing an atmosphere in which they may flourish.

John W Greve

EDITOR

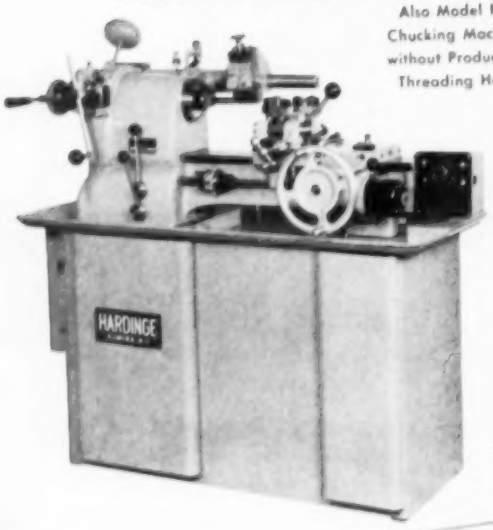
Precision
PRODUCTION MACHINES

HARDINGE
ELMIRA, N.Y.

Precision
TOOL ROOM MACHINES

HARDINGE Model HCT
Chucking Machine with Production Threading Head

Also Model HC Chucking Machine without Production Threading Head



HARDINGE Model HLV
Tool Room Lathe

HARDINGE Model DSM59
Second Operation Machine

HARDINGE Model UM
Universal Milling Machine

Also Model TM Plain Milling Machine

HARDINGE Model TFB

Turning, Facing and Boring Machine

HARDINGE Model DV59
Lathe

ALL MACHINES *Feature* **HARDINGE Preloaded Ball Bearing Spindle Construction for High Speeds**

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

New Snyder Special Transfer Rod

HARDINGE
ELMIRA, N.Y.

TO GET *Better Performance* and *Better Production*

Style "S" Master Collets and Pads

The only Master Collet
with no Work Pressure on the Screw

Style "B" Master Feed Fingers and Pads

Pads Cannot Work Loose
No Screws No Pins

COLLETS
for ALL AUTOMATICS
CHUCKING MACHINES
TURRET LATHES

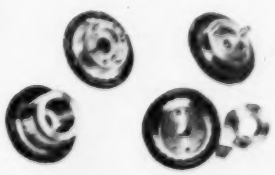
COLLETS
for ALL LATHES
and MILLERS

Complete Capacity
Round, Hexagon and Square

HARDINGE SJOGREN
COLLET CHUCKS

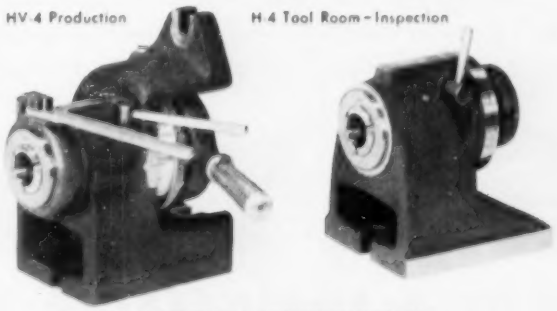
Five Sizes 1" 1⅜" 1¼" 2¼" and 3½" Collet Capacity

For Threaded, Tapered Key-Drive, Cam-Lock, and American Standard Spindles.



HV-4 Production

H-4 Tool Room–Inspection



INDEX FIXTURES

Increase Production by
Holding Work Accurately and
Indexing Rapidly

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

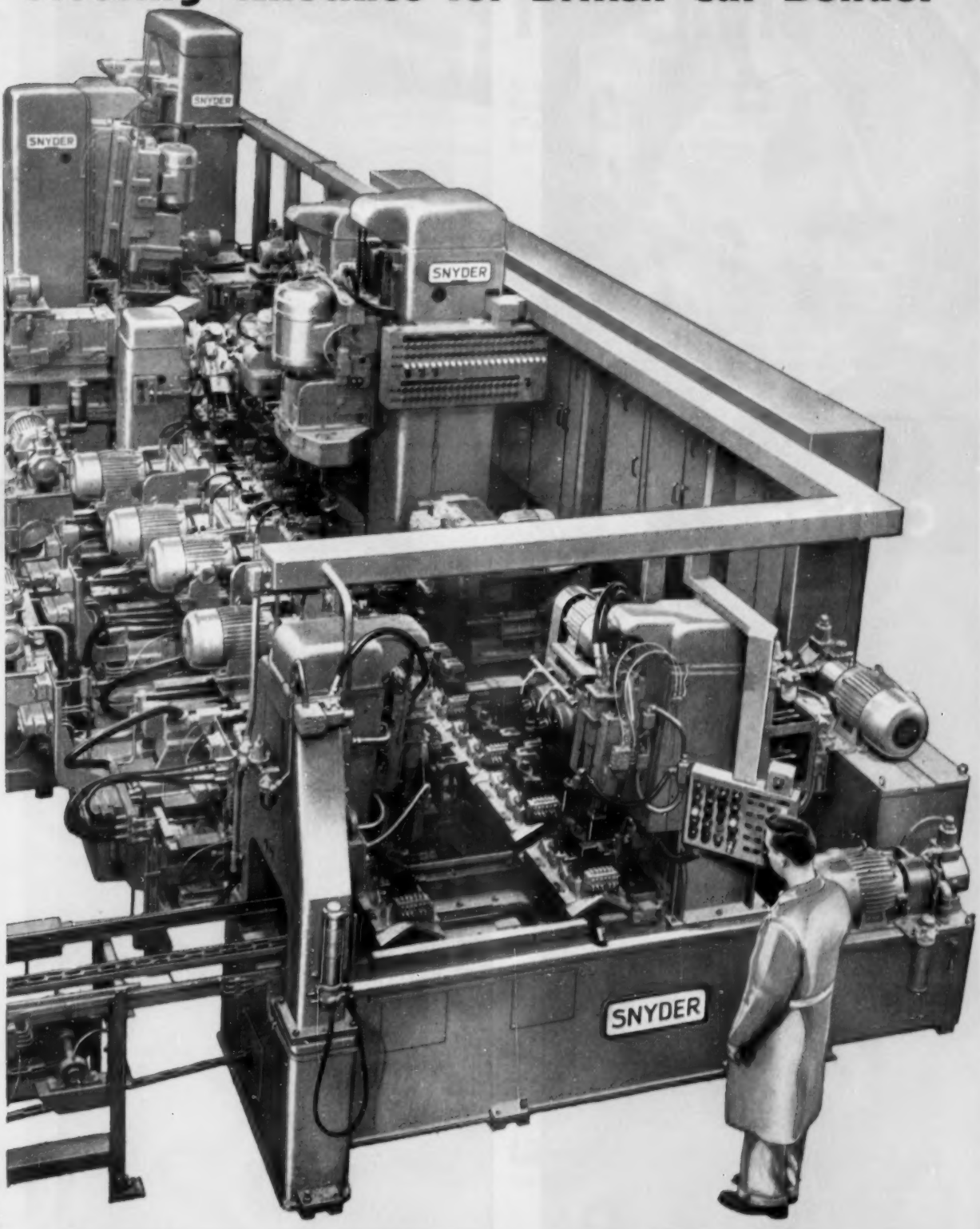
SNYDER

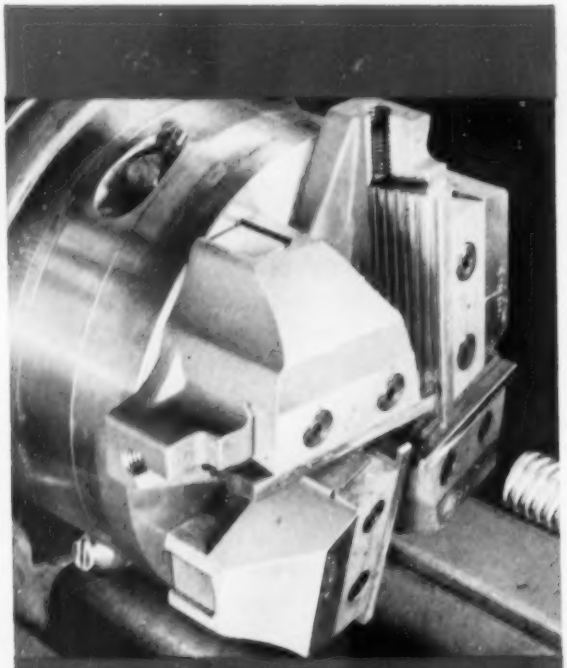
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

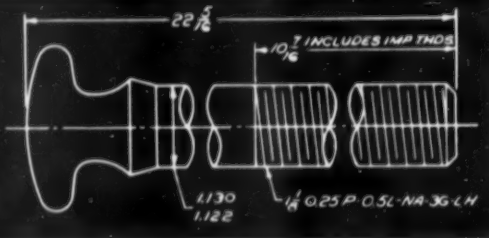
Several Semi-Standard Machines with Steering Knuckles for British Car Builder



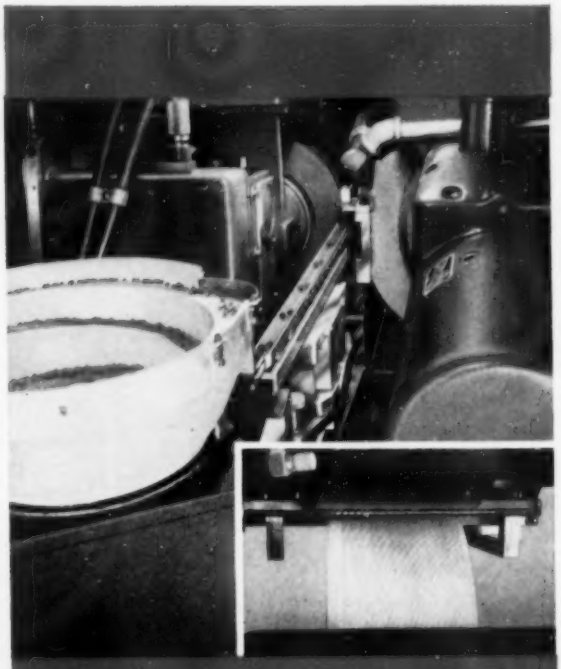


Cutting

Workpiece:	Valve Stem
Thread Spec.:	
Diameter	1-1/8"
Length	10-7/16"
Type	1/4"P. 1/2" lead, double left-hand Acme
Tolerance	Class 3
Threading Time:	24 sec.

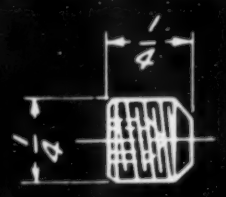


Threading is by the new 16C LANDMACO Single-Spindle Leadscrew Threading Machine fitted with 2" LANCO Heat-Treated Head using Roughing and Finishing Chasers with Centering Throats. This equipment is designed to produce a thread of excellent finish despite heavy metal removal, and eliminate the out-of-roundness common in long workpieces. Long life between grinds of the LANDIS Tangential Chasers for 80% of their length will hold tool cost to a minimum.



Grinding

Workpiece:	Set Screw
Thread Spec.:	
Diameter	1/4"
Thread length	1/4"
Type	20P-U.N.C.
Tolerance	Class 3
Production:	7,500 pieces per hour

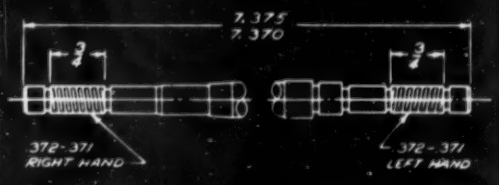


Threading is performed by continuous thru-feed grinding on a #1 LANDIS Centerless Thread Grinder. Operation is automatic—blanks are fed by a vibratory hopper—finished pieces ejected into a tray. This operation indicates the mass production possibilities of the centerless thread grinding method. Infeed grinding may be used for many shouldered workpieces which may not be threaded satisfactorily by either Cutting or Rolling.

443-C-2

Rolling

Workpiece:	Worm shaft (50 carbon alloy steel of 25 Rockwell C)
Thread Spec.:	
Diameter	3/8"
Length	3/4"
Type	Triple worm, .100" P, .300" lead
Tolerance	.003 concen. with main bearing journals
Production:	12 pieces per minute



These worms are produced by infeed rolling on the new LANHYROL Thread Rolling Machine. Featuring manual loading and semi-automatic cycling, this operation illustrates the difficult threads which can be rolled to provide tremendous cost savings. Thrufeed, continuous and reciprocal rolling methods are also available when required by conditions of material hardness or workpiece design. Special fixtures and automatic loading mechanisms facilitate high production operations.

THREADING..

As a result of more than 50 years of Engineering, Research, and Production Experience, LANDIS offers the most complete line of machines and tools for producing threads:

CUTTING

THREADING MACHINES—90 sizes and styles for precision threading from 3/16" to 6", and pipe threading from 1/8" to 20".

DIE HEADS—102 sizes and styles featuring the LANDIS Tangential Chaser for economy in commercial and precision threading on all types of machines. Capacities from #4 to 9-1/4" in diameter.

COLLAPSIBLE TAPS—130 sizes and styles of stationary and rotary taps, for taper or straight threading, with a range from 1-1/4" to 24".

GRINDING

Centerless Thread Grinders to thread all diameters from #4 to 3-1/2", utilizing either in-feed or thru-feed grinding.

ROLLING

THREAD ROLLING MACHINES—the LANHYROL Machine threads all diameters from 3/16" to 3" by the chipless, cold-forming process; and offers unequalled output, flexibility, and range coverage.

THREAD ROLLING ATTACHMENTS—five sizes of the LANROLL Attachments for bar automatics produce straight threads to Class 4 tolerances from #5 to 1-3/4", and taper pipe threads from 1/16" to 1-1/4".

May we suggest the most efficient method of producing your thread? LANDIS Engineers will work with you on any problem dealing with method, equipment, or thread design. Our staff of Field Representatives assure you of satisfactory operation—and, in addition, all LANDIS Equipment is guaranteed to produce the thread for which it is sold.

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U.S.A.

Any Dial Indicator Dollars in your Suggestion Box?

BY

ROBERT C. GOULD, SALES ENGINEER

STANDARD GAGE COMPANY, INC.

PLANT suggestion boxes are paying-off to management and employees alike. These boxes are providing a major share of the "new ideas" leading to improved operating efficiency, better products and lower costs. It is not surprising that many of the suggestions cover the use and care of Dial Indicators. We believe that some of them are worth discussing here.

Q. How many times do you pay for a dial indicator?

Initial price is only *first* cost. Overall cost includes paperwork, labor and repair parts. On a repair purchase order the paperwork averages $14.75. Repair an indicator 3 or 4 times and you've paid for it 2 or 3 times! Then, add to this the cost of higher inventories, inspection errors and production delays. Get the PRICE from purchasing... the COST from accounting.

Q. Why is it necessary to stock large quantities of dial indicator repair parts?

It isn't! Wear should not account for more than 10% of all indicator repairs; 90% of maintenance should be for cleaning only.

Q. Are jewel bearings worth the extra cost?

Jewel bearings add considerably to the initial price of a dial indicator—but what's the return on your investment? More accuracy? Usually not. More SHOCKPROOF? Definitely not. Easier maintenance? Most certainly not. Does this mean that jewel bearings are worthless? No, indeed! Where the last milligram of friction is highly critical, such as in Standard's CHECK MASTER TEST INDICATOR, jewel bearings are worth the cost. But... AGD Dial Indicators do not need jewels for accuracy; nor are they as SHOCKPROOF with jewels. Standard's special bronze, minimum-of-friction, long-life bearings have proved themselves superior to jewels by nearly 20 years of testing and customer use.

Q. "100% SHOCKPROOF"—is it worth the extra cost?

Definitely! Fully SHOCKPROOF is a must. But with Standard it costs nothing extra! Standard's original SHOCKPROOF design prevents *any* shock on the contact point from ever reaching the precision gears and bearings. Over 15 years of trouble-free use by industry proves the point!

Your Man-from-Standard will be glad to discuss these and other Dial Indicator questions with you. It may well be your "first step" to lower indicator cost.

a complete line of **GAGES**

- indicating,
- fixed and
- adjustable limit types

WRITE FOR CATALOG

STANDARD Gages

171 PARKER AVENUE • POUGHKEEPSIE, NEW YORK

GET GREATER GRINDER PRODUCTION BETTER SURFACE FINISHES LOWER PRODUCTION COST

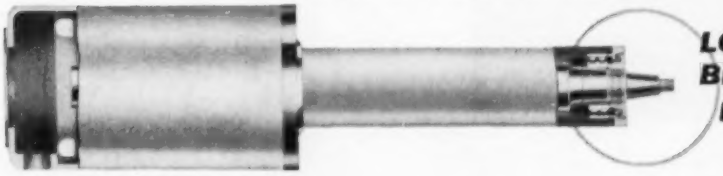
From all your Surface Grinders, new or old

Specify POPE HEAVY DUTY, MOTORIZED SPINDLES

POPE 1, 2 and 3 HP, 1800 or 3600 RPM Surface Grinder Spindles:

- **assure continuous production of accurate parts.**
- **revolve accurately under the heaviest loads.**
- **permanently lubricated (Pope System) for the life of the bearings.**
- **have the rigidity to support diamond wheels and to produce *more good work.***
- **have the extra rigidity for crush dressing and form grinding.**

WRITE FOR PRICE AND DELIVERY.



LOOK AT THE BEARINGS! permanently preloaded

These super-precision, double row cylindrical roller bearings have the capacity to assure smooth, chatter-free operation over a long life — give the Spindle the ability to rough off surplus metal fast but maintain its inbuilt precision for producing fine finishes.

Separate super-precision ball thrust bearings eliminate endwise movement of the shaft in either direction.

No. 117

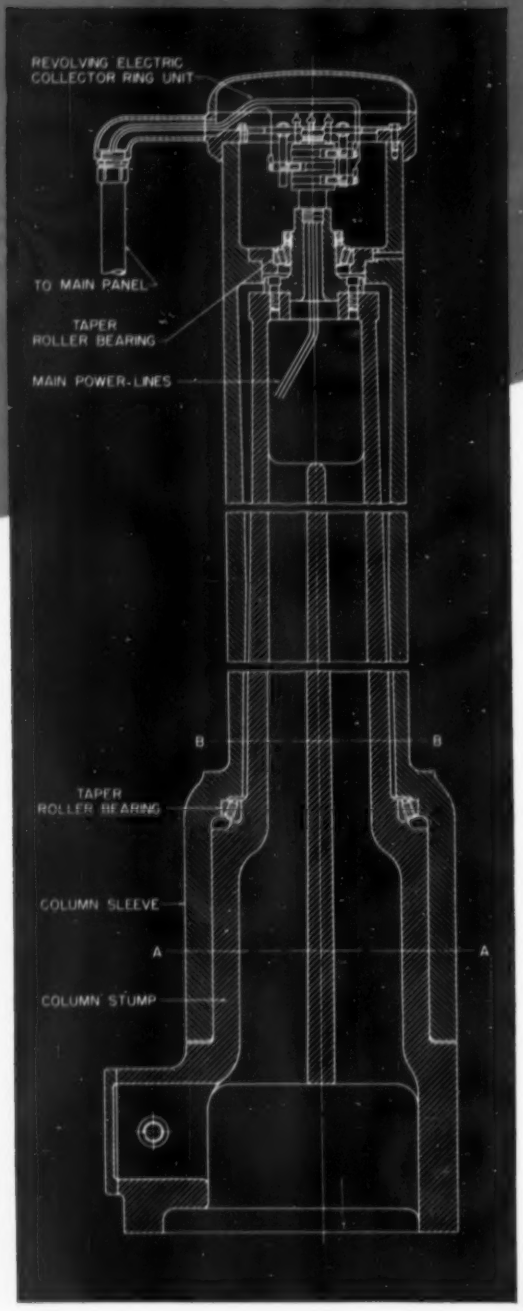
POPE®

ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

Rigidity Increased 50%



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

Large Timken bearings at top and bottom when preloaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.

Write for Bulletin No. 328 for the complete story of More and Better Work at Lower Cost.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

ON TIME
....EVERY TIME!
YOUR TIME IS WORTH MONEY... for "on time" delivery of precision drill jig bushings — smallest to the largest, or specials to your order — there is no better service than American's.
For the RIGHT drill bushing WHEN you want it... use American drill bushings. There is an exclusive American Distributor near you with complete stocks to help you keep production rolling.
SEND FOR THE CATALOGS THAT TAKE THE HEADACHE OUT OF ORDERING DRILL JIG BUSHINGS — AND THE NAME OF OUR DISTRIBUTOR NEAR YOU.
American
DRILL BUSHING CO.
5107 PACIFIC BOULEVARD
LOS ANGELES 58, CALIFORNIA

THE MOST
That's Why More People

You get the greatest of all selections from which you can pick the right instrument for your job.

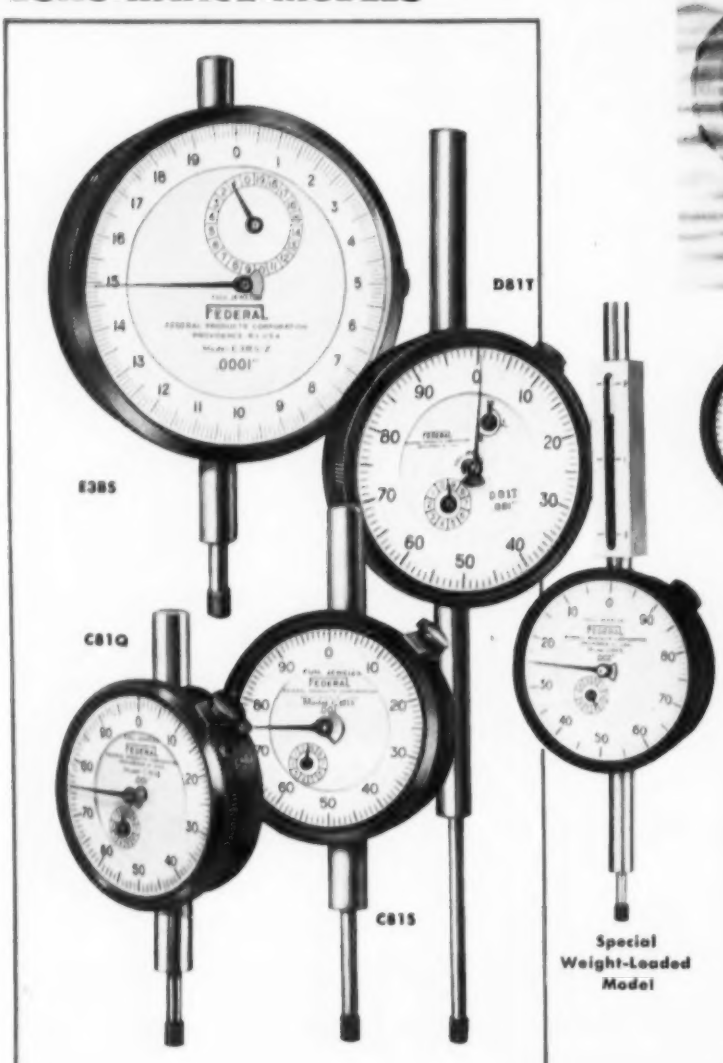
You get the benefits of doing business with a company which consistently offers improvements and new ideas.

You get a known accuracy and dependability built up over years of development and experience.

You save the confusion of stocking and maintaining several different makes of instruments.

PERPENDICULAR TYPES
3 Graduations 7 Models

LONG RANGE MODELS



WETPROOF
Completely Sealed

Completely protected from coolant, oil, oil fog, and water. Also protected from dust. Cushioned movement. Extra heavy case for rough usage. Extra strong mounting. Selection of 4 graduations, 6 ranges. A Federal "new".

SHOCKPROOF
Indicators

Proven winners in competitive endurance tests. Shock is absorbed and prevented from reaching sensitive and precisely aligned parts. No additional friction. No sacrifice in accuracy.

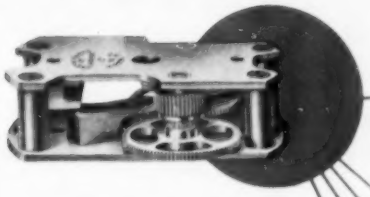
28 PAGE CATALOG
all Dial Indicators
Yours for the asking
Write

for YOUR MONEY

Standardize on—

FEDERAL

DIAL INDICATORS



UNIT MOVEMENT

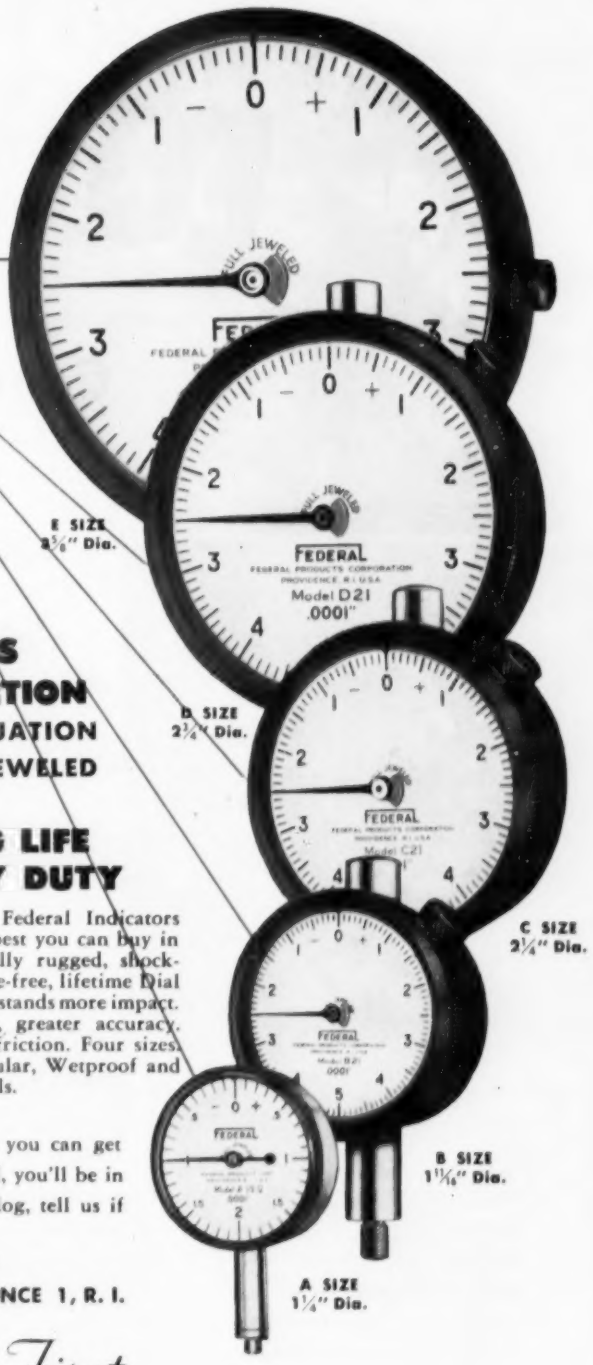
Assures Perfect Alignment
Positive Adjustment — Rigidity —
High Accuracy . . .

Maintenance men tell us repeatedly it is the easiest to repair.

FIVE SIZES
LOW FRICTION
ANY GRADUATION
PLAIN OR JEWELED

LONG LIFE
HEAVY DUTY

Another new in Federal Indicators (H Model). The best you can buy in every way. A really rugged, shock-proof, maintenance-free, lifetime Dial Indicator that withstands more impact. Low maintenance, greater accuracy. 16% to 25% less friction. Four sizes. Furnished in Regular, Wetproof and Long Range models.



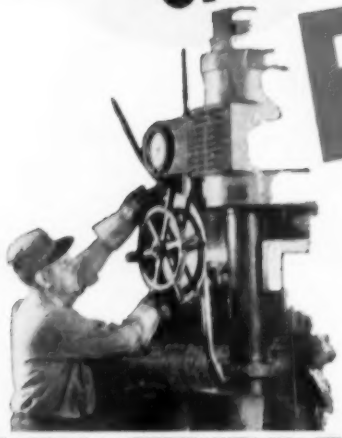
Whatever you need in Dial Indicators and Accessories you can get from Federal (direct from our Branch Offices too.) And, you'll be in line for new developments later. If you haven't a catalog, tell us if you want one.

FEDERAL PRODUCTS CORPORATION
7193 EDDY STREET **PROVIDENCE 1, R. I.**

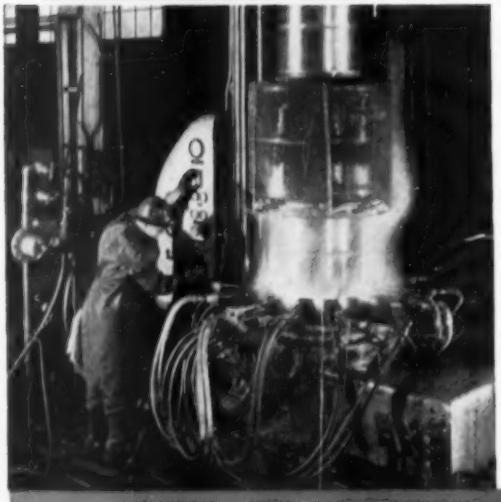
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

YOU CAN'T BEAT THE COMBINATION OF SKILLS and EQUIPMENT



...which ONLY the Commercial Heat Treater can provide



Today's modern commercial heat treating plant might well be described as a "department store" for metal treating services. For under one roof are offered you not only the full range of heat treating equipment for all types of processes . . . but . . . of still greater importance, the manpower skills of the management and technicians of those supervising and performing your jobs. *Service* is their keynote.

Whatever your needs . . . whenever you need it . . .

● CONSULT YOUR COMMERCIAL HEAT TREATER!

MASTER CRAFTSMEN — METAL TREATING INSTITUTE

American Metal Treatment Co.
Elizabeth, New Jersey

Anderson Steel Treating Co.
Detroit, Michigan

B. & W. Precision Heat Treating Co.
Kitchener, Ontario, Canada

Benedict-Miller, Inc.
Lyndhurst, New Jersey

Bennett Heat Treating Co., Inc.
Newark 3, New Jersey

Commercial Metal Treating, Inc.
Bridgeport, Conn.

Cook Heat Treating Co. of Texas
Houston 11, Texas

The Dayton Forging & Heat Treating Co.
Dayton 3, Ohio

Dominy Heat Treating Corp.
Dallas, Texas

Drever Company
Philadelphia 23, Pennsylvania

Greenman Steel Treating Company
Worcester 5, Massachusetts

Fred Heinzelman & Sons
New York 12, New York

Alfred Heller Heat Treating Co.
New York 38, New York

Hollywood Heat Treating Co.
Los Angeles 38, California

L-R Heat Treating Company
Newark, New Jersey

The Lakeside Steel Improvement Co.
Cleveland 14, Ohio

Metallurgical, Inc.
Minneapolis 14, Minnesota

Metallurgical, Inc.
Kansas City 8, Missouri

Metlab Company
Philadelphia 18, Pennsylvania

New England Metallurgical Corp.
South Boston 27, Massachusetts

Paulo Products Company
St. Louis 10, Missouri

Pittsburgh Commercial Heat Treating Co.
Pittsburgh 1, Pennsylvania

The Queen City Steel Treating Co.
Cincinnati 25, Ohio

J. W. Rex Company
Lansdale, Pennsylvania

Stanley P. Rockwell Company
Hartford 12, Connecticut

C. U. Scott & Son, Inc.
(Stainless Steels)
Rock Island, Illinois

Standard Steel Treating Co.
Detroit 10, Michigan

Syracuse Heat Treating Corp.
Syracuse, New York

Winton Heat Treating Company
Cleveland 16, Ohio

MASTERLINE — GISHOLT

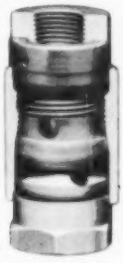
MODERNIZE FOR PROFITS WITH

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.



No. 1

No. 2

No. 3

No. 4

No. 5

No. 6

(1) 1/2" Flo-Set Speed Control Valve assembly; (2) valve body section and (3) valve body profile after first operation (1.35 min. f.t.f.); (4) valve stem after first operation (1.30 min. f.t.f.); (5) valve adjusting sleeve (completed in .85 min. f.t.f.); (6) valve collar (completed in .55 min. f.t.f.)

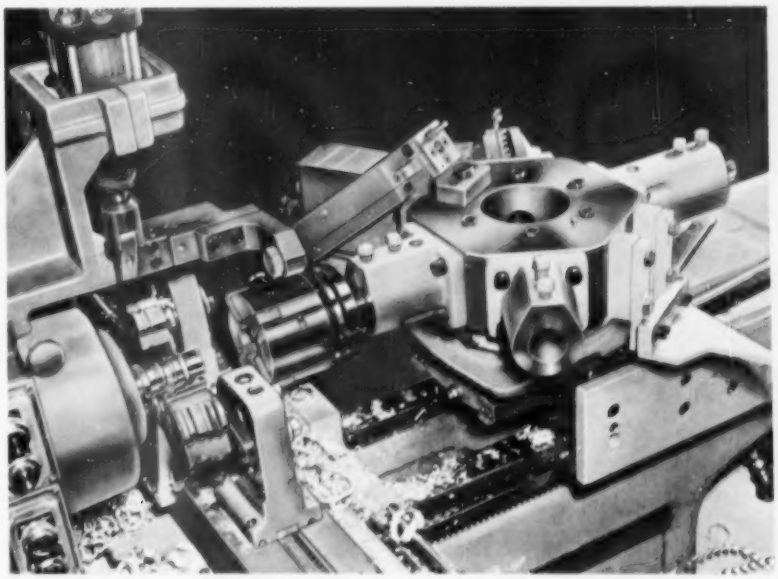
HANNA ENGINEERING CUTS MACHINING TIME 47% ON VALVE PARTS

Automatic cycle on ram type turret lathe reduces costs, boosts production, minimizes attention from the operator

This smart setup reveals how Hanna Engineering Works, Chicago, Ill., has stepped up production to an automatic basis with a variety of Flo-Set Speed Control Valve parts—machined from round and hexagon aluminum bar stock.

Average time reduction over former methods is 47%, using a Gisholt No. 5 Ram Type Turret Lathe equipped with a hydraulic drive unit which controls all machine functions.

Here's a typical fully automatic operating sequence on a ½" size valve body (No. 2 above). A portion of the O.D. is formed by a circular cutter on the front of the cross slide. Hexagon turret tools start drill, finish 2 diameters and a taper in the I.D. with a step drill, form an internal recess and chamfer the I.D. with a turret slide tool actuated from a stop on the cross slide, and thread a portion of the O.D. The bar stock is unchucked, advanced to a headstock-mounted swinging stock stop, re-chucked, and the finished part is cut off from the rear of the cross slide while part of the O.D. on the next workpiece is formed by the same circular cutter. The cycle then repeats. Floor-to-floor time? Just 1.35 minutes.



Tooling close-up for 1/2" valve body. Note overhead swinging stock stop, and circular forming cutters on front and rear of cross slide.

Four different sizes of valve bodies and valve adjusting sleeves, and 3 different sizes of valve stems and valve collars are produced in this manner. Setup time is no longer than that for a standard hand-operated turret lathe. After completing setup, the operator simply removes finished parts, inspects, makes occasional tool changes or adjustments, and inserts new bar stock as required.

Hydraulic drive on ram type turret lathe offers continuous production without operator fatigue...assures high accuracy, consistent quality, maximum tool life through correct speeds and feeds on all operations.

THE GISHOLT MASTERLINE

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

MODERNIZE FOR PROFITS WITH

REMOVES 520 POUNDS IN ROUGHING THIS PART

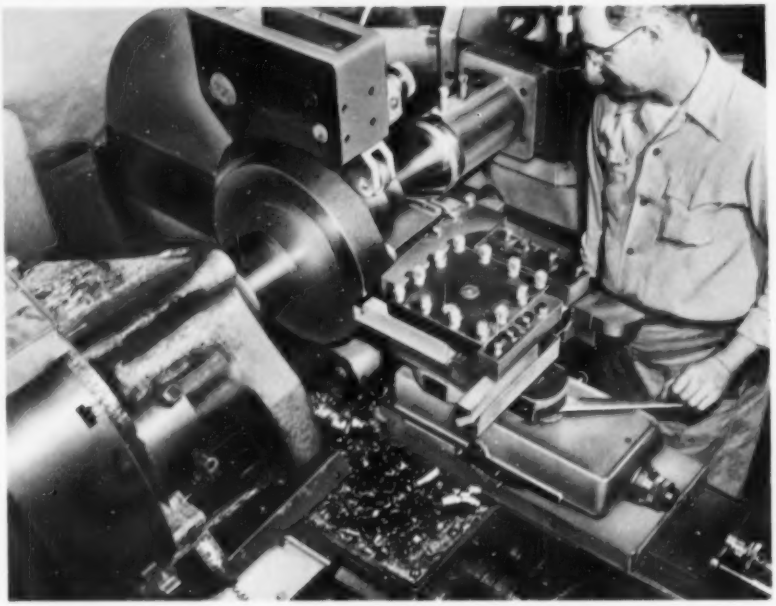
Open side steadyrest solves clearance problems

Here's how one manufacturer takes advantage of the sheer power and rigidity of the 5L Saddle Type Turret Lathe, to cut machining costs on difficult parts. This 1190-pound steel turbine control valve casting is typical of what the 5L can do.

A special faceplate fixture—centralized and held in a 32" 4-jaw independent chuck—is used to locate, clamp and drive the part on the base end. Ample support during machining is assured by a turret-mounted live center and an open side steadyrest, mounted on the rear bedway and supported on a rail on the back of the bed casting. This type of steadyrest does not impede cross slide carriage movements, nor does it obstruct the tooling.

With this setup, all O. D. machining is handled from the compound tool post. Deep cuts are accommodated by special tool holders, giving maximum support to the overhanging tools. Hexagon turret tools re-center, start-drill and drill through the workpiece to complete the operation. In 197 minutes machining time the 5L, using a 75 hp. motor, removes 520 pounds of steel on this job.

Compound tool post on 5L proves rigid enough for heavy cuts, is ready to use for taper-turning operations on other parts.

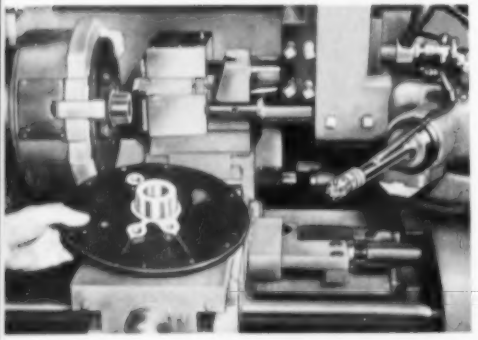


Close-up of square turret tooling and open side steadyrest. Note fixture used to locate, clamp and drive part, which is approximately 36" long.

Workpiece before and after rough machining. Minimum clearance on deep cuts requires special tool holders on square turret for adequate support during heavy cuts.

SPECIAL TOOL BLOCK SOLVES TRICKY JOB ON 1F FASTERMATIC

Woodruff & Edwards, Inc., uses triple-tooled automatic lathe to increase production

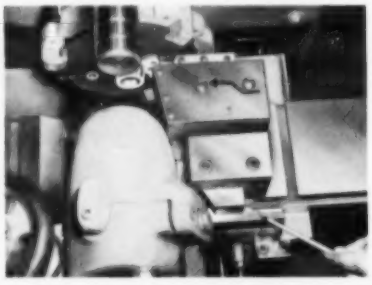


Close-up shows workpiece and two turret faces with tooling which turns, bores, chamfers, faces and reams to complete each part.

Cam-operated rear cross slide tooling from overhead. Arrow indicates path of tool travel.

Check this efficient setup. With it, Woodruff & Edwards, Inc., of Elgin, Illinois, uses the Fastermatic Automatic Turret Lathe cycle—to finish-machine 3 gray iron transmission tops with each complete index of the hexagon turret.

A special drawback fixture holds the workpiece, which is centralized and located on 2 dowel pin holes against the previously machined and ground back face. Special drawback fingers clamp on the O.D.



Identically tooled stations 1, 3 and 5 turn the hub O.D., bore and chamfer while rear cross slide tools face the hub and flange bosses. Stations 2, 4 and 6 finish-ream the bore. The machine stops on stations 2, 4 and 6, the part is unchucked and a new workpiece inserted, and the machining cycle is repeated.

A tapered cam on the rear cross slide permits facing the flange and hub bosses without hitting the drawback fingers gripping on the O.D. The tool block moves in until the tooling clears the fingers; then the tapered angle of the cam moves a sliding tool holder within the block to machine the faces.

Triple-tooled turret on Fastermatic produces 3 finished parts for each index, with f.t.f. time of 1.08 minutes per part.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

time? Just 1.55 minutes.

simply removes finished parts, in-

correct speeds and feeds on all operations.

THE GISHOLT MASTERLINE

GISHOLT

TIME-SAVING IDEAS

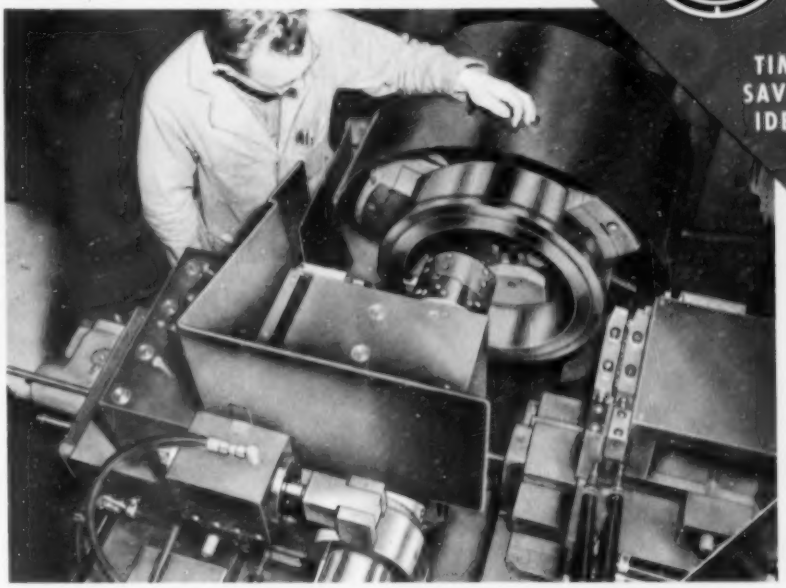
CALIFORNIA PELLET MILL CO. CUTS LARGE PART CHANGE-OVER

Simplifies operator's job with adjustable slides, special tool blocks, clamp-on tools on No. 24

You'll spot smart planning in the way a wide variety of steel pellet mill die forgings—ranging up to 20¾" diam.—is machined by California Pellet Mill Co. at San Francisco, Calif., and Crawfordsville, Ind.

Rugged Gisholt MASTERLINE No. 24 Automatic Production Lathes perform 4 different operations on each workpiece. Work is held in a 28", 3-jaw air chuck. Plain chuck jaws hold the largest part; inserts and adjustable jacks add the flexibility to handle smaller parts.

Change-over from one operation to the other is fast, simple and low in cost. Front and rear tool blocks are quickly adjusted. Tool shanks are mounted in slots cut in the tool blocks. Longitudinal slots in the shanks permit fast in-or-out screw adjustment. To handle the required surfaces, the operator adds or removes necessary tool bits. For finish boring, a hydraulically operated off-center pivoting tool relief eliminates tool tracks. The 2-speed motor provides desired low speed for the deep grooving cuts. A load meter on the headstock signals tool changes by indicating power increase requirements.



Finishing operation on 20¾" diam. part. Hydraulic cylinder at rear of front slide operates linkage to pivot boring tool off-center before withdrawal, eliminating tool tracks.

No. 24 completely roughs and finishes each part in 4 operations: turning O.D., boring I.D., facing both ends, grooving and forming. Total f.t.f. time on 20¾" diam. part is only 24 minutes.

INDEXING TURNTABLE HOLDS IDLE TIME TO ONLY 18 SECONDS

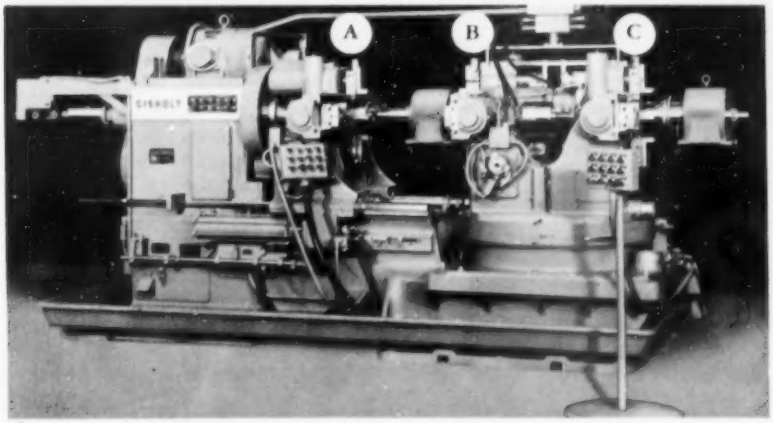
Permits loading and unloading on Simplimatic while new part is being machined

With this well-planned setup, the manufacturer is handling over 30 different sizes of electric motor frames. Three identical groups of tools are used, mounted on vertical heads A, B and C. Each group includes an independent rough and finish facing slide, and a rough and finish boring head.

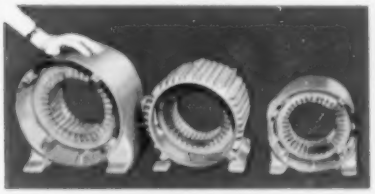
Heads B and C carry expanding mandrels to permit chucking in the I.D. They are mounted on an indexing turntable, to permit loading and unloading operations at one end while machining is performed at the other. Head A traverses toward the turntable, with a special spindle arbor mating with the mandrel to drive the part. A clutch at the base of head A engages a clutch at the base of the turntable, actuating the tooling, simultaneously machining the work at both ends. Head A reverse-traverses, disengages all driving clutches, and clears the turntable to permit indexing a new part into machining position.

Change-over is fast. Tool slides are repositioned and expanding mandrels changed. Dial indicators speed tool setting.

5,000-lb. turntable indexes and head A reverse-traverses and returns in 18 seconds—only idle time in entire operation. F.t.f. times range from .85 min. on 8¾" O.D. workpieces to 2.34 minutes on 12" O.D.



Indexing turntable shows workpieces on both ends. Note head A retracted to permit indexing new piece into position.



Three different workpiece sizes, showing range handled with this setup.

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

GISHOLT

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

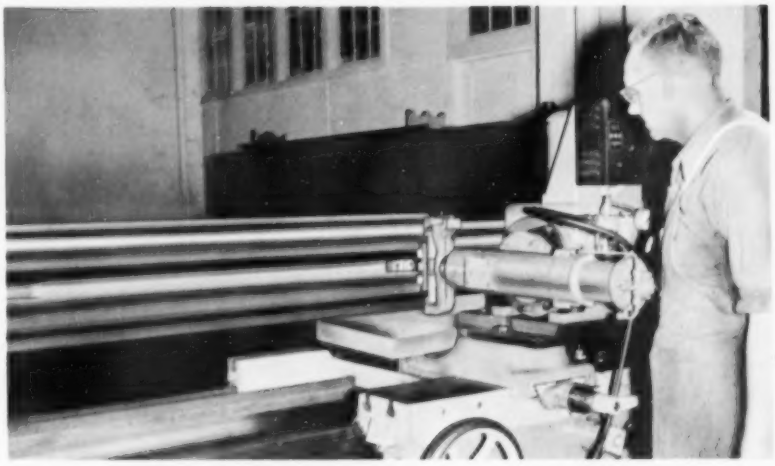
ERIE ORDNANCE SUPERFINISHES 155 MM. GUN TUBES FOR LONGER LIFE

Mounts inexpensive attachment on lathe to save time, cut costs

Here's an interesting job that may point the way to better quality at less cost in your own finishing operations.

To prepare new and reconditioned artillery pieces for service, Erie Ordnance Plant, LaCarne, Ohio, frequently has to refinish galled or scored gun tube O.D.'s. Often the tubes meet drawing requirements, but still carry toolmarks perpendicular to direction of recoil—causing a filing action on the brass recoil liners.

To reduce refinishing time and obtain an improved surface finish, Erie Ordnance mounted a Gisholt No. 4 Superfinishing attachment on a lathe with enough capacity to handle all gun tube sizes. A typical part is the 155 mm. tube shown here, 12½" diam. by 64" long, with a smaller 10" diam. and a 64" length with a keyway. A special 3-stone holder permits Superfinishing over the keyways without difficulty.



Special 3-stone holder used to Superfinish over keyway on 155 mm. gun tube.

With previous methods, up to 2 days were required for a single tube. With the modern Superfinishing attachment, 15 to 16 tubes are completed in two 8-hour shifts, varying slightly depending on surface conditions. All sizes are handled on same attachment by changing stone holders and adjusting oscillation rates and stone pressures.

Superfinisher attachment reduces surface finish readings from as high as 50-60 micro-inches—including deep marks from galling and scoring—down to 8-12 micro-inches in minimum f.i.f. time.

BALANCES 77 FLYWHEELS AN HOUR, INCLUDING CORRECTION AND INSPECTION

Gisholt 1SV1 locates, measures, corrects and inspects for unbalance in single handling

Close-up of workpiece on adapter and integral correction equipment. Note that the correction radius may be easily changed by turning handwheel behind workpiece. This feature permits handling many different part sizes with minimum change-over time.

The trick here is to get high-production balancing on large-diameter, narrow-width parts requiring correction in a single plane. A Gisholt 1SV1 Vertical Balancer does the job easily.

The workpiece—an automatic transmission flywheel—is placed on a special adapter and rotated. The Direct Reading Amount Meter and strobe light, which indicates the angle of the unbalance, are mounted in one housing, permitting the operator to observe the angle and amount of unbalance simultaneously in the same visual field. To correct for unbalance he stops the spindle and positions the part for correction at the observed angle. He then lowers the drill, which actuates an air-operated thrust device (visible on the left of the workpiece) to support during the correction drilling operation.

Drilling to the precise correction depth is made easy by calibrating the Direct Reading Amount Meter. The operator simply matches the reading with a simple scale on the drill press. Unbalance is usually corrected by drilling 3 holes or less, promoting the production of 77 parts an hour at 80% efficiency.

Correction equipment mounted integrally with Gisholt Balancer permits completing all operations in single handling.

DYNETRIC BALANCERS GISHOLT

No. 3-457
678

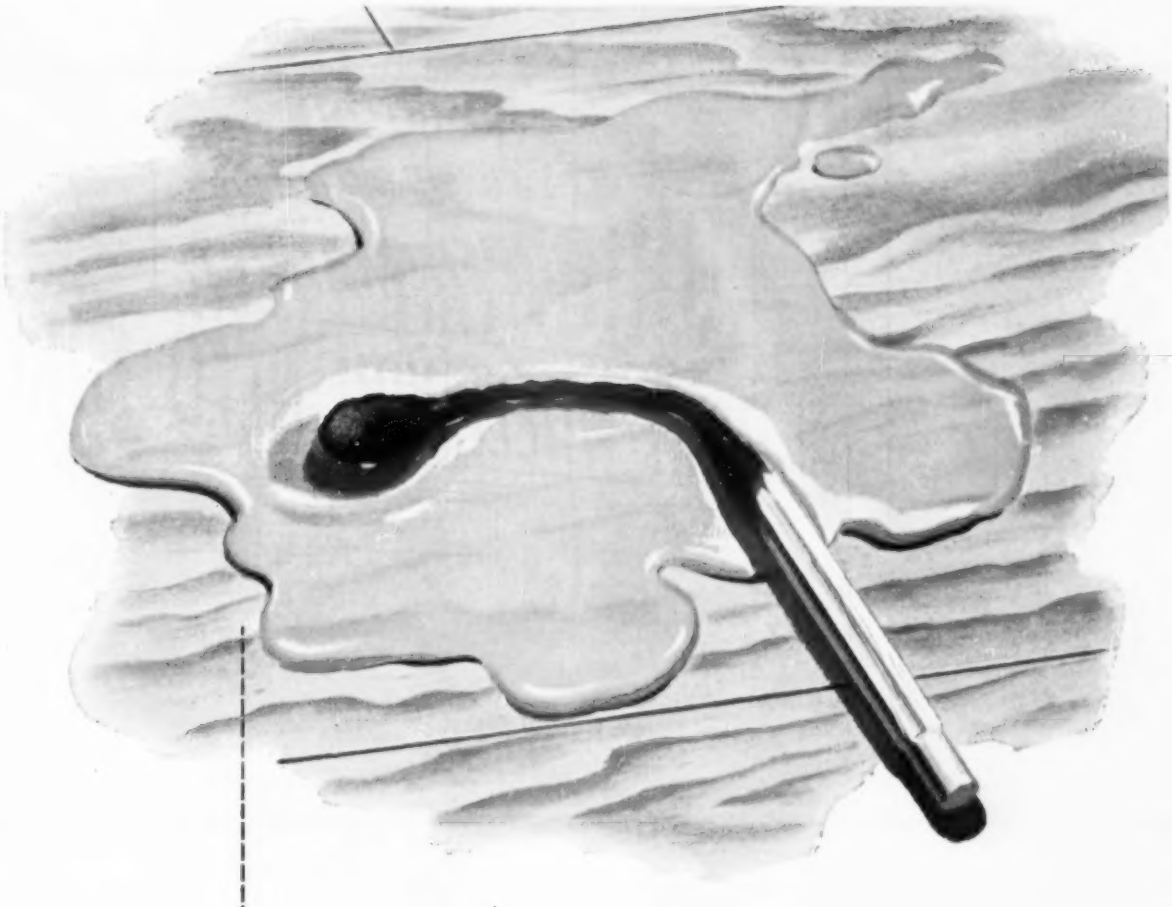
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Printed in U.S.A.

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



An economical hydraulic fluid that actually snuffs out fire!

WHEREVER a fire hazard exists near a hydraulic system, you can greatly reduce this hazard without excessive costs by specifying Shell Irus Fluid 902. This new hydraulic fluid is a "snuffer" type fluid with water dispersed in oil.

Because Irus* Fluid 902 is economical, many plant operators have found they save thousands of dollars yearly when the changeover is made. And they obtain performance which is unsurpassed by much higher priced fire-resistant fluids.

For complete information on Shell Irus Fluid 902 write to Shell Oil Company, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

*Trademark

SHELL IRUS FLUID 902

SHELL

Let's toss a bouquet to the modern super-market — one of the greatest time and trouble savers in present-day living.

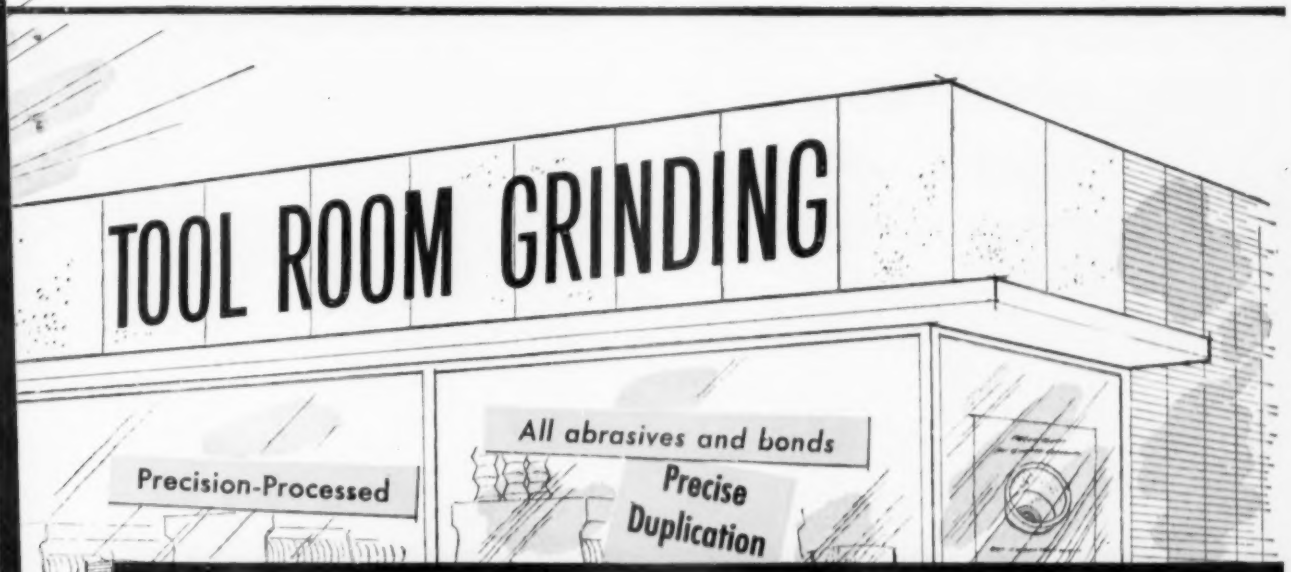
But, have you ever stopped to think that, in the abrasives field, Norton brings you real super-market convenience? Here, in the world's largest line of abrasive products, is everything you need for every grinding job.

Take tool room grinding wheels. In these, as in all other categories, the Norton line is 100% complete. You don't have to shop around — going to one source for wheels that will sharpen steel tools, to another for diamond wheels, to another for mounted wheels.

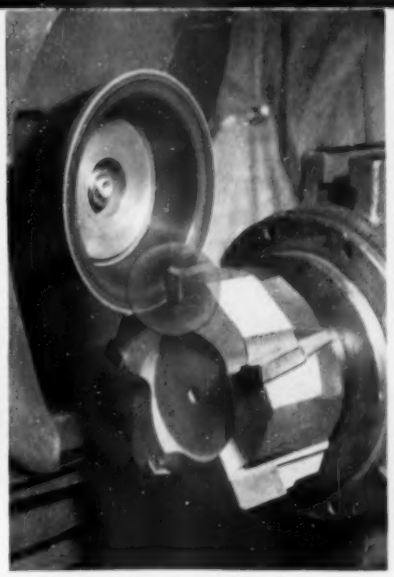
You can get them all at Norton. And they're all the best wheels that can possibly be made. The advanced equipment and broad experience you find at Norton you'll find nowhere else in abrasives manufacture.

Advantages like these mean leadership. And they result in precision-processed, precision-performing wheels that grind exactly alike — from wheel to wheel and lot to lot.

See Your Norton Distributor for wheels that will bring the value-adding, profit-boosting "Touch of Gold" to all your tool room grinding operations. Ask him for the two helpful booklets — *A Handbook on Tool Room Grinding* and a booklet on *How To Select Wheels For Precision Grinding Tool And Constructional Steels.* Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**



FOR SHARPENING STEEL TOOLS, as well as for surface, cylindrical and internal grinding on all steels, Norton G Bond and BE Bond Wheels — in 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM or the new non-premium priced 44 ALUNDUM abrasive — add the money-saving, cost-cutting "Touch of Gold." These vitrified bonds are the most efficient ever developed for precision and semi-precision grinding.



FOR CARBIDE GRINDING, Norton diamond wheels are the recognized "Crown Jewels." Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding. For many carbide grinding jobs Norton K Bond CRYSTOLON* wheels are often the best investment.

FOR DIE AND MOLD FINISHING Norton mounted wheels bring you big savings on the widest range of tool room jobs. They're a 100% complete line, for all requirements.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

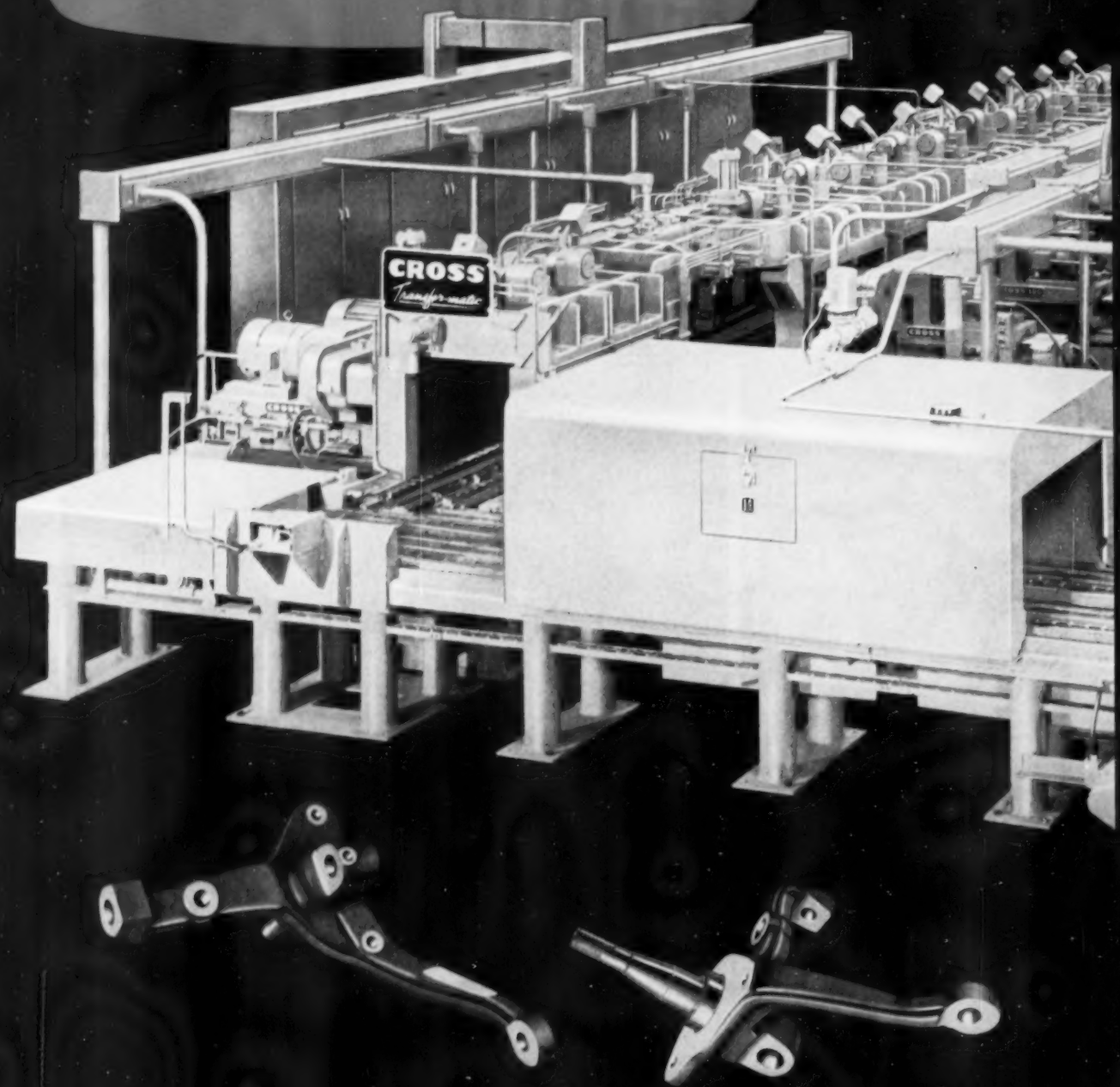
NORTON
ABRASIVES

Making better products...
to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

W-1763

Mills, Drills, Reams, Threads Integral Front Wheel Spindle and Steering Arm



Established 1898

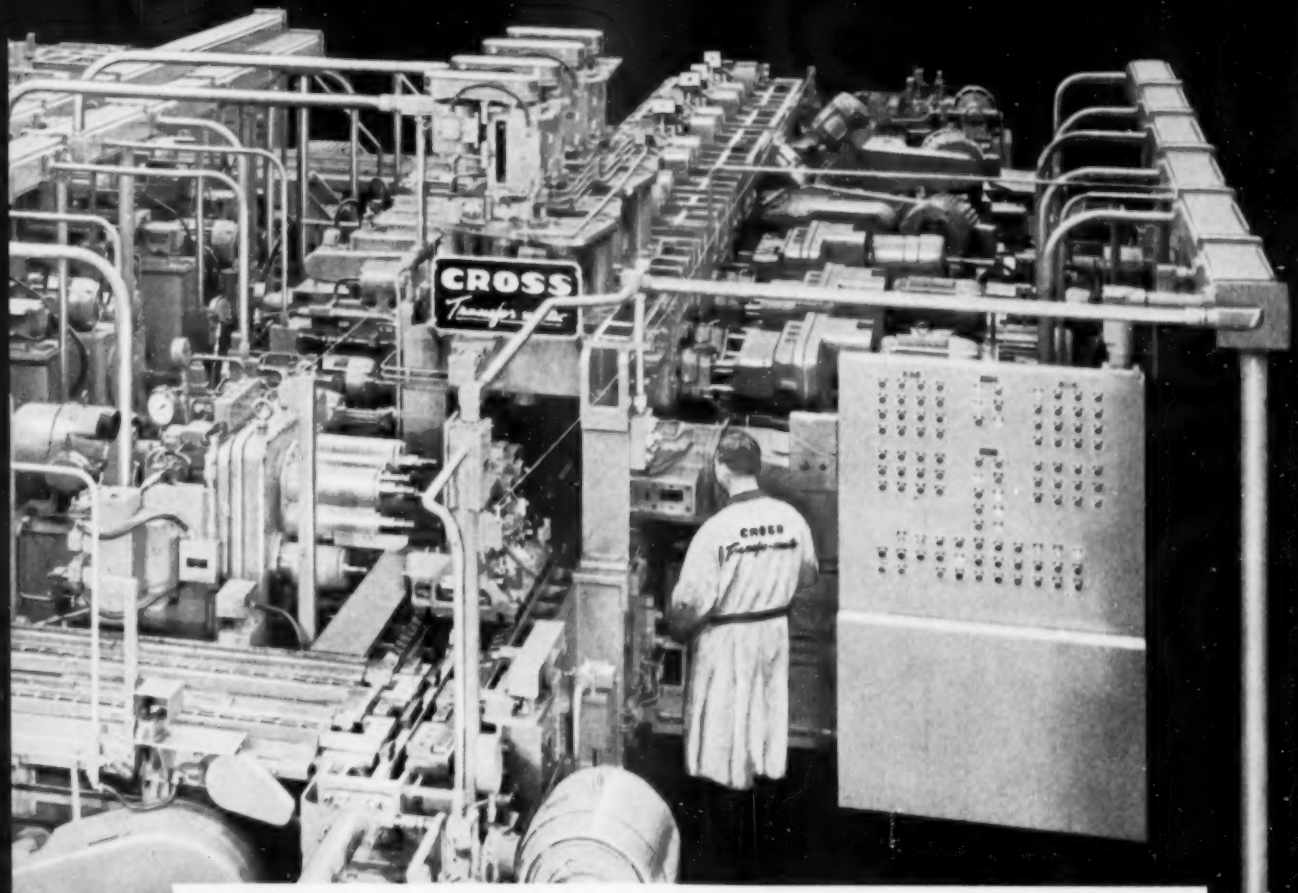
THE **CROSS** CO.

First in Automation

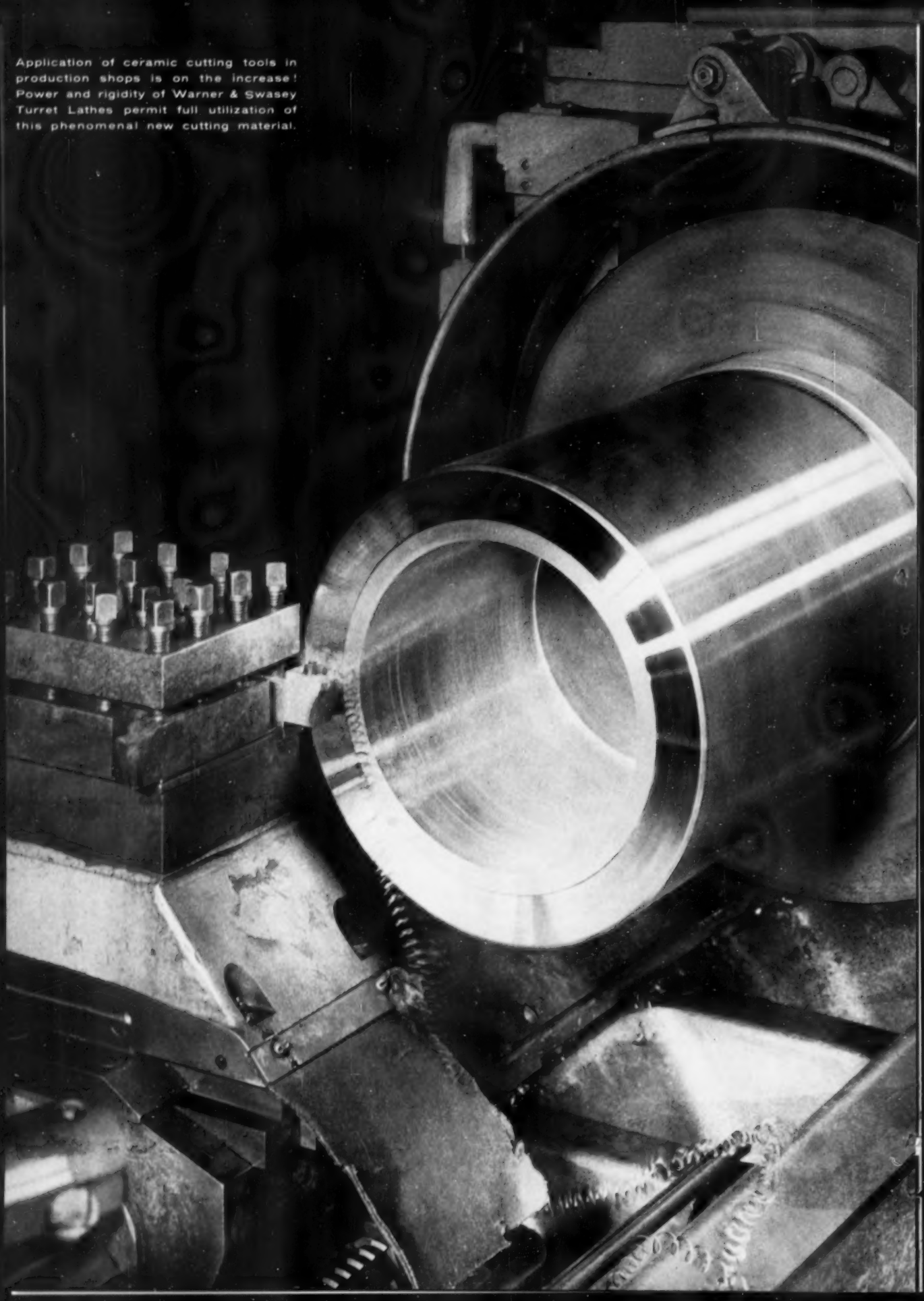
PARK GROVE STATION • DETROIT 5, MICHIGAN

Application of ceramic cutting tools in

Another Transfer-matic by Cross



- ★ Straddle mills upper and lower support arm bosses; straddle mills steering arm boss; mills steering arm stop pad; mills spindle keyway; drills and taper reams upper and lower support arm holes and steering arm hole; drills, reams, chamfers and spotfaces two brake mounting plate holes; drills, counterbores, spotfaces, chamfers and reams brake anchor hole; drills spindle cotter pin hole; and threads wheel spindle.
- ★ 144 right and 144 left hand parts per hour at 100% efficiency.
- ★ Pallet type work holding fixtures locate parts from spindle bearing diameters.
- ★ Power wrench clamps work holding fixtures automatically.
- ★ Gravity operated cam clamps for the work holding fixtures.
- ★ Automatic transfer mechanism indexes right and left hand parts through all 17 stations in pairs.
- ★ Automatic indexing units turn fixtures 82° at Stations 11 and 17.
- ★ Cross modular unit construction provides flexibility for design changes.
- ★ Other features: construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; complete interchangeability of all standard and special parts for easy maintenance.



Application of ceramic cutting tools in production shops is on the increase! Power and rigidity of Warner & Swasey Turret Lathes permit full utilization of this phenomenal new cutting material.

Warner & Swasey's continuing Metalcutting Research Program is helping to find...

what Ceramic Tooling can mean to you!

Evaluation of today's new and revolutionary ceramic cutting tools is but another step in Warner & Swasey's ever-continuing metalcutting research program. Only through such constant engineering investigation, study and testing can answers be found to your ever-present question, "How can we machine it better, faster, for less?".

Highlighting the American Society of Tool Engineers' Silver Anniversary meeting at Houston, Texas, March 25 through 27, will be a CERAMIC TOOLING SYMPOSIUM of which Warner & Swasey is proud to be a co-sponsor together with the Massachusetts Institute of Technology and Ohio State University.

A display of ceramic tools and specially-adapted equipment will be featured along with the presentation of technical papers covering ceramic tooling's historical background, laboratory findings and the practical advantages and disadvantages of industrial applications.

A panel discussion by leading authorities will answer your specific questions regarding the potential application of ceramic cutters in your own shop.

We are looking forward to seeing you in Houston!

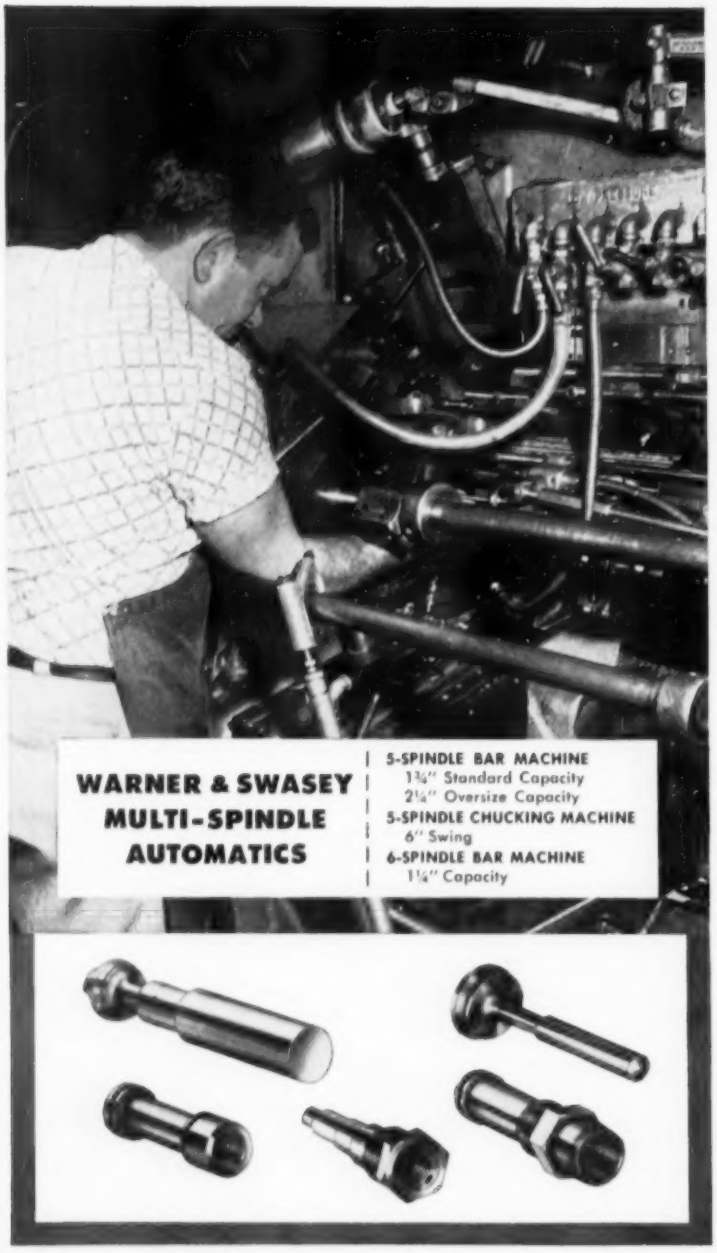
SILVER ANNIVERSARY MEETING
MARCH 25-27 1957
HOUSTON TEXAS
CERAMIC SYMPOSIUM

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

WARNER & SWASEY AUTOMATIC CUTS SMALL LOT COSTS...

solves inventory problem for Cleco Division, Reed Roller Bit Company



Cleco Division, Houston, Texas, manufactures a wide variety of air tools. About 6000 different component parts must be machined each year—and, in order to keep reasonable inventory, in relatively small lots ranging from 100 to 1000 pieces.

While production on small hand-operated turret lathes kept inventory in line, it resulted in too high a cost per piece. On the other hand, economical production on conventional automatics required larger lot sizes and higher inventories.

In 1948, Cleco installed a Warner & Swasey 5-Spindle Automatic to solve both these problems. Its quick setup permits machining small lots at automatic rates —reducing cost per piece, and inventory at the same time.

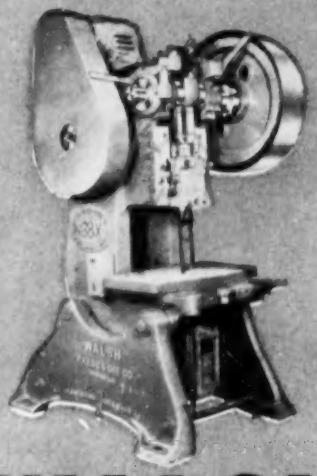
This automatic has been operated on a two-shift basis—the equivalent of 16 years of one-shift production—with an exceptionally low record of downtime. Only $144 has been spent for repair parts. And despite this usage, cross slide form cuts to within .002" are easily held.

Foreman O. R. Palmer says: "We handle as much of our short run work as possible on the Warner & Swasey. Only when there's more such work scheduled than the machine can accommodate do we route the surplus to other automatics." Cleco operators like the automatic's quick-set quadrants which eliminate cam changing for feed strokes, its micrometer-dial cross slide adjustment, and general ease of operation.

If you'd like to reduce your machining costs on small and medium lot production —as well as long runs—call in our Field Representative. He'll be able to tell you whether your work can be done more profitably on a Warner & Swasey Multi-Spindle Automatic.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY



WALSH PRESSES

Rugged as the Rockies

Some made in 1907 with rugged dependability are *still* operating at a profit.
Wide selection of sizes from 6-65 tons . . . STOCK to 4 weeks delivery.
24 HOUR REPAIR *SERVICE*
See Bulletin 353 for more details.

WALSH PRESS & DIE CO.
4709 W. Kinzie St. • Chicago 44, Illinois
ESTebrook 3-6700

SIZE CONTROL REVERSIBLE GAGES

. . . give you 5 or more gages for the price of one—*reversible* and extra length for new gaging surfaces at no additional cost.
THREAD REVERSIBLES
PLAIN REVERSIBLES
Complete details in catalog 53

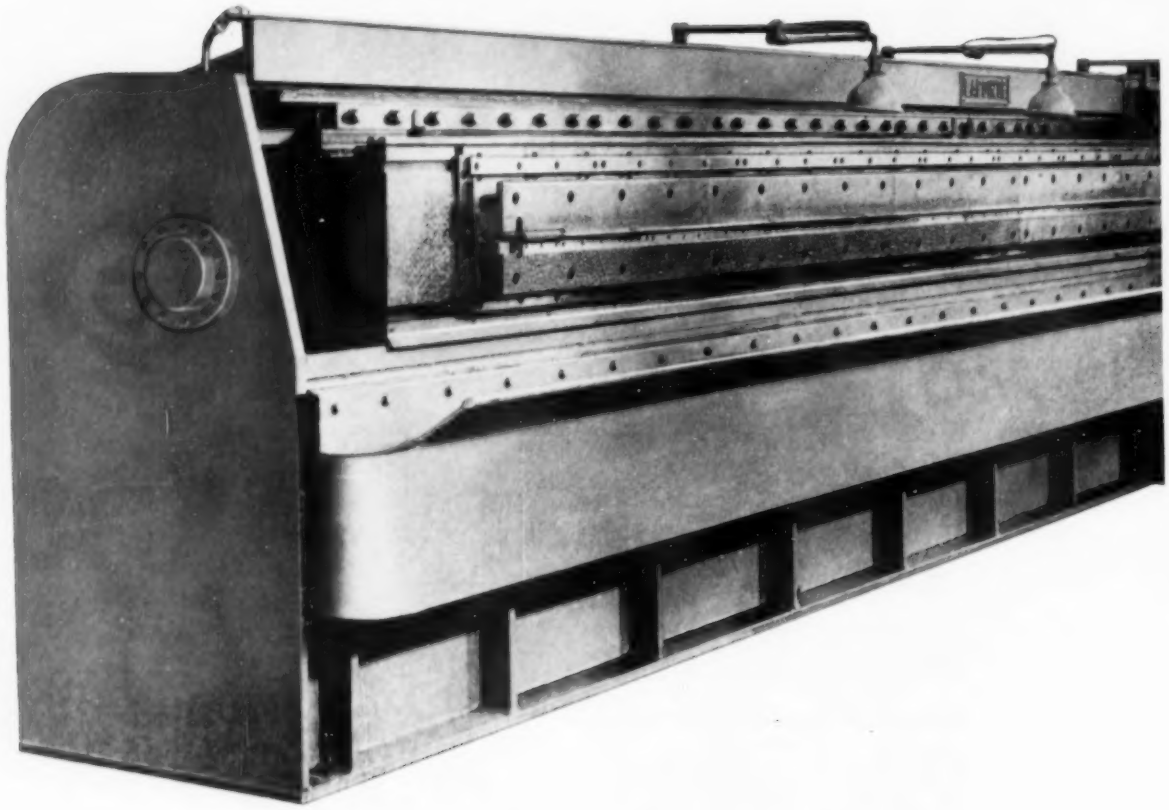
SIZE CONTROL CO.
2500 W. Washington Boulevard
Chicago 12, Ill. • MOnroe 6-6710

Divisions of
AMERICAN GAGE and MACHINE CO.
SIMPSON ELECTRIC COMPANY SIZE CONTROL COMPANY
WALSH PRESS & DIE COMPANY
STANDARD TRANSFORMER CO.

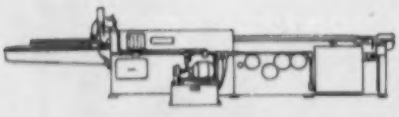
World's largest broaching machine!

the new LAPOINTE ELECTRO-MECHANICAL® BROACH

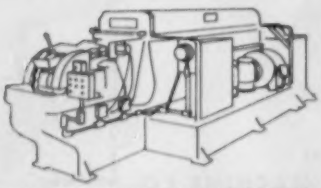
built with 240-inch stroke!



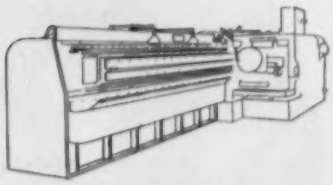
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



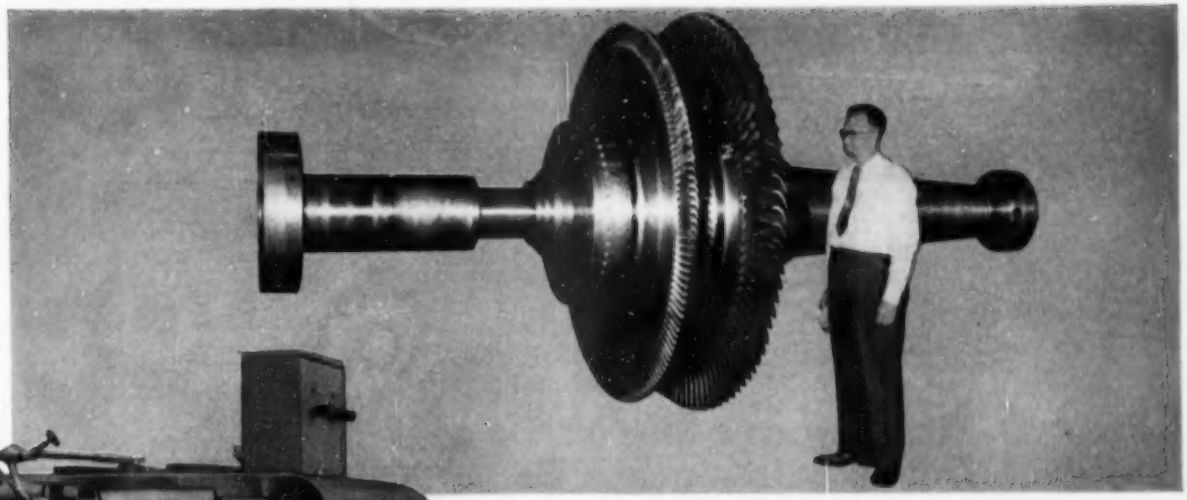
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHB SINGLE RAM HORIZONTAL, ELECTRIC



Designed for broaching the "pine tree" form on wheels for a stationary gas turbine, this machine can accommodate turbine wheels up to 80-inch diameter, 9-inch rim thickness! Such heavy broaching is easy for this machine, which is built with the powerful continuous tooth herringbone type bull gear and rack.

BROACHING TAKES A GIANT STEP

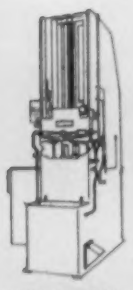
Broaching has entered the leviathan stage! It joins the family of really big machines — the giant grinders, the mammoth millers, the prodigious presses and planers.

To Lapointe goes the credit for engineering and building this biggest of all broaches, for Lapointe was known to have the facilities and the know-how to do the job. And with all its size, this broach will of course hold the extreme tolerances required for indexing and broaching the intricate "pine tree" form on gas turbine wheels.

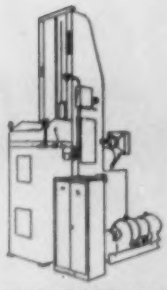
This latest accomplishment is another indication of Lapointe's ability to anticipate the demands of industry. Lapointe — with 54 years of broach-building experience — has always led the field in developing broaching machines, broaching fixtures, and broaches. "When BIGGER and BETTER broaching machines are built, LAPOINTE will build 'em!"

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

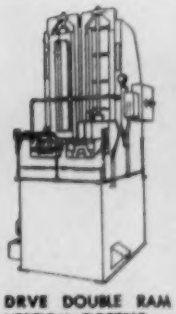
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



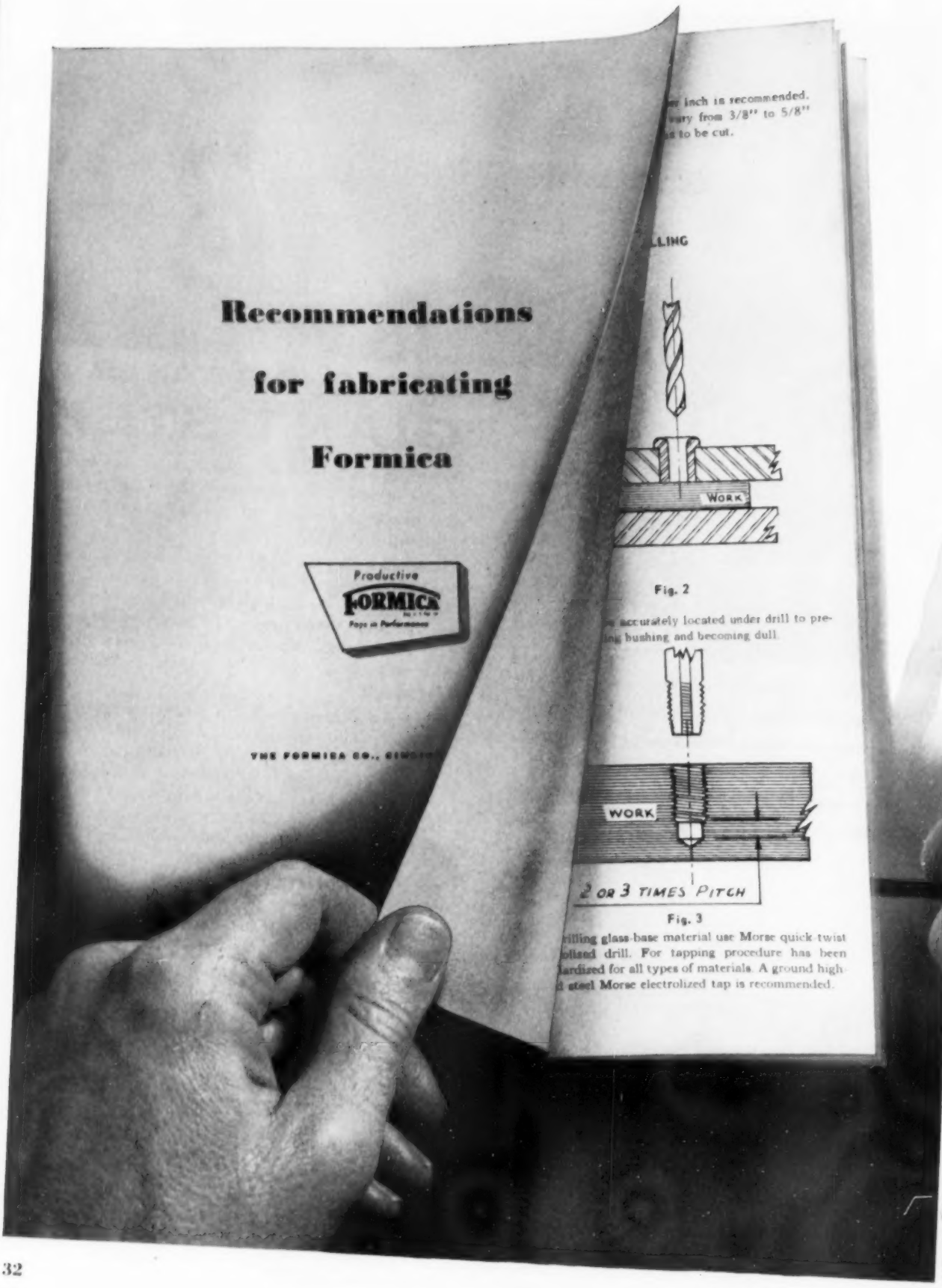
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-31


Recommendations
for fabricating
Formica
Productive
FORMICA
Pays in Performance
THE FORMICA CO.,
inch is recommended.
vary from 3/8" to 5/8"
to be cut.
LLING
WORK
Fig. 2
accurately located under drill to pre-
ing bushing and becoming dull.
WORK
2 OR 3 TIMES PITCH
Fig. 3
illing glass-base material use Morse quick-twist
olized drill. For tapping procedure has been
dardized for all types of materials. A ground high-
steel Morse electrolized tap is recommended.

Why FORMICA says:

Reg. U. S. Pat. Off.

"Use MORSE Electrolized Tools!"

Top performance on the job, hole after hole after hole . . . that's why the instruction manual of the Formica Corporation specifies:

"*For Drilling Glass-Base Material:*
MORSE Quick-Twist *Electrolized* Drill . . .

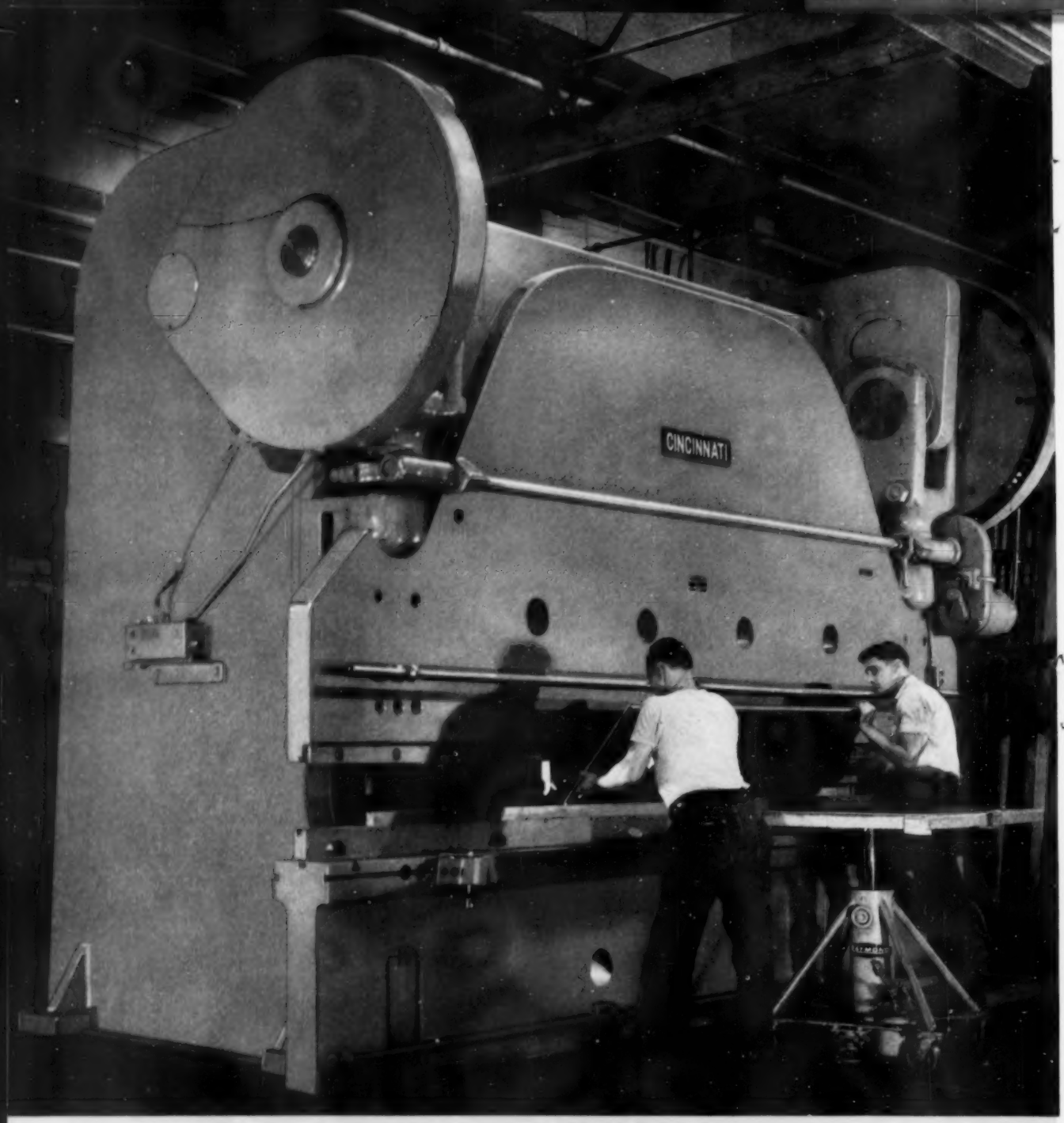
"*For Drilling Paper and Fabric-Base Materials:*
MORSE Slow-Spiral *Electrolized* Bakelite Drill . . .

"*For Tapping:*
Procedure has been standardized for all types of materials.
A ground High-Speed Steel MORSE *Electrolized* Tap is recommended."

Formica, like every other concern that has tested it, finds that the exclusive MORSE process of *Electrolizing* gives up to 30% longer tool life on the toughest jobs. And the only source for *Electrolized* cutting tools is the Morse-Franchised Distributor.

MORSE TWIST DRILL & MACHINE COMPANY • NEW BEDFORD, MASS.
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE means "THE MOST" in Cutting Tools



This 13 Series x 12′ Cincinnati Press Brake has a capacity of 250 tons and is used for many types of forming and punching work at the Falstrom Plant.

This 2512 Series Cincinnati Shear has a capacity of ⅜″ x 12′ long mild steel plate, and is used to shear a variety of metals to micrometer accuracy.

● Photos courtesy Falstrom Company, Passaic, N. J.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

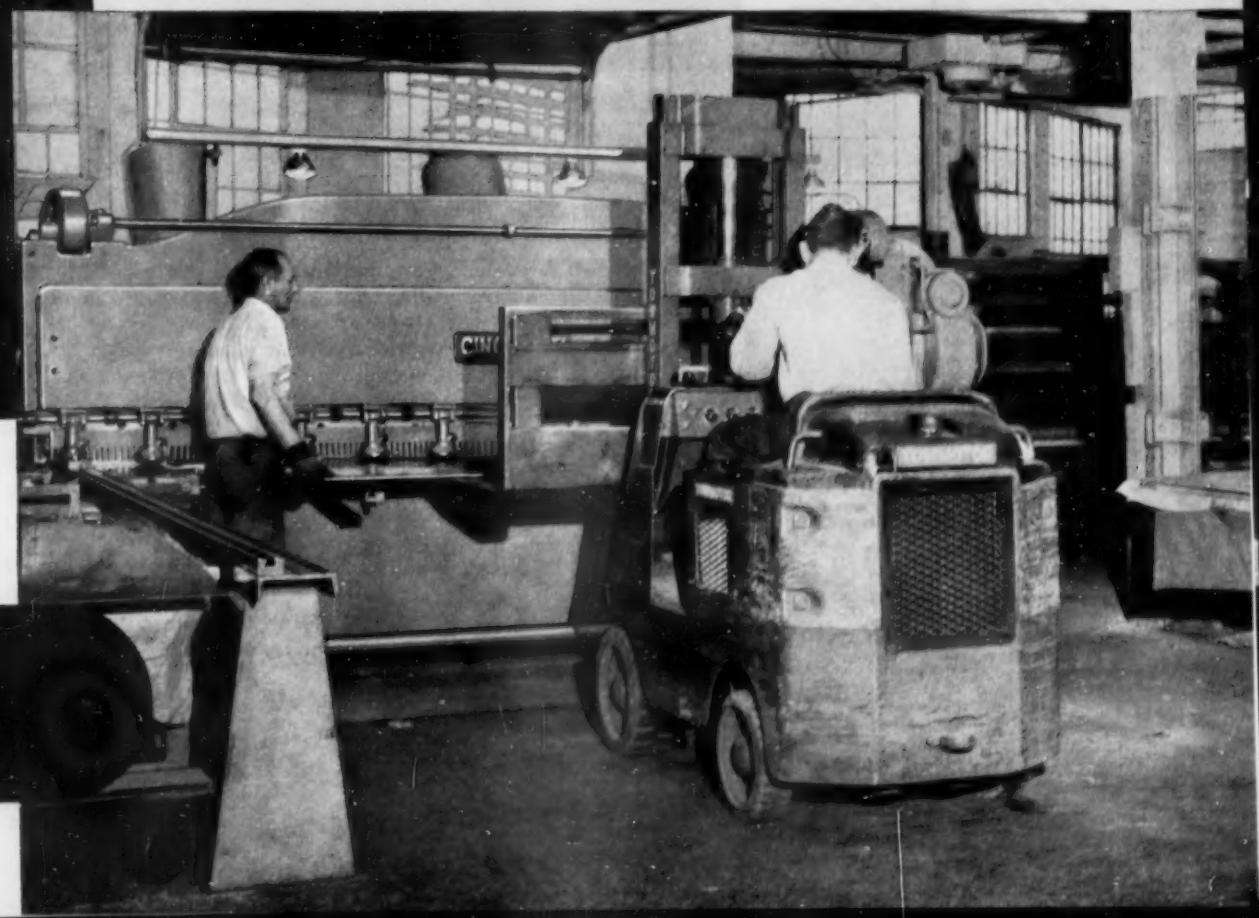
Cincinnati Shears and Press Brakes produce a wide variety of precision custom metal work

at FALSTROM COMPANY, Passaic, N. J.

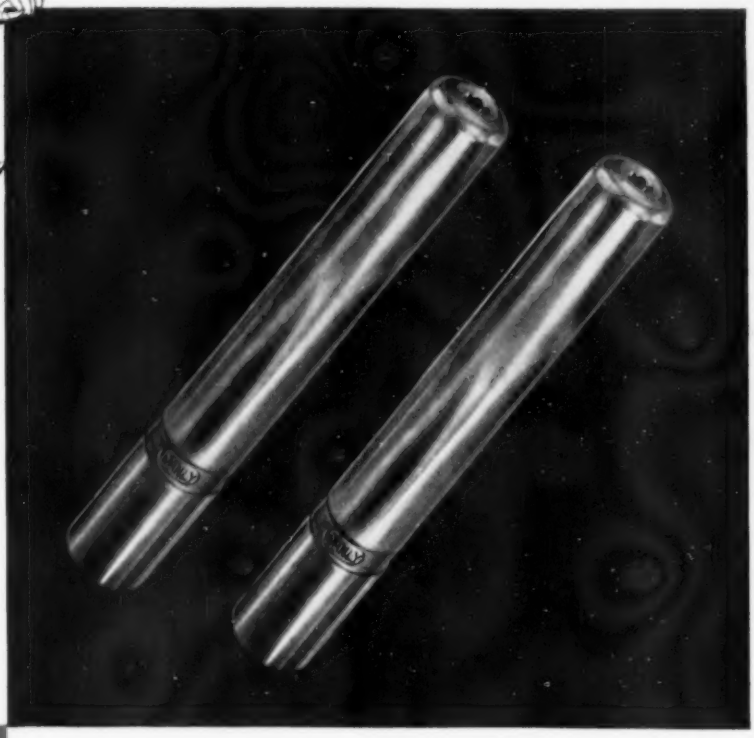
Three Cincinnati Shears and five Cincinnati Press Brakes are profitable producers in this finely equipped plant. A broad variety of precision work in many different metals is done on these versatile machines, yet changes from job to job are made rapidly with minimum loss of time. Due to the accuracy of their Cincinnati Shears and Press Brakes, Falstrom Company has been able to minimize the use of welded construction in their special fabricated products.

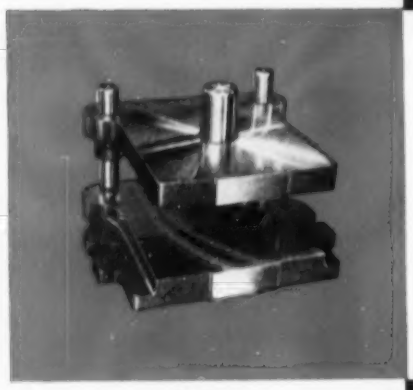
•

Consult our Application Engineering Department about ***your*** production problems, and write Department E for Catalog S-7R on Cincinnati Shears and Catalog B-4R on Cincinnati Press Brakes.



NEW "Microme" chrome plated guide posts





ON NEW DANLY DIE SETS

Now standard on all Danly precision die sets, MICROME chrome plated guide posts typify Danly leadership in die set design. Years in development, they represent only a part of Danly's never-ending effort to provide the finest in quality. These new posts are extremely hard and have very high resistance to wear. Super smooth finish helps to guarantee lasting precision performance . . . they are another important reason why you should specify Danly die sets.

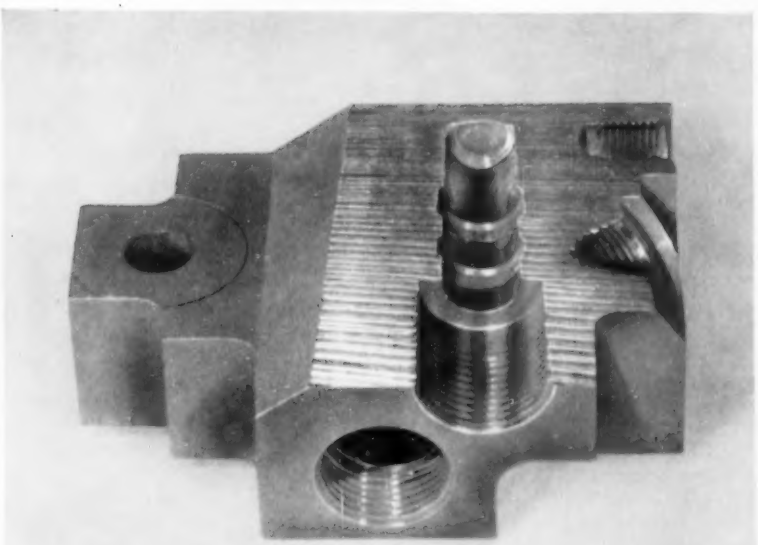
Complete new "leadership line" catalog

More than 200 pages provide you with complete design information, easier selection of die sets and supplies. Write for your copy today!

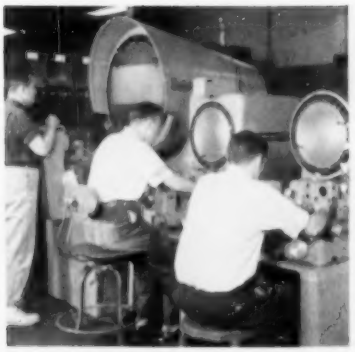
DANLY

DANLY MACHINE SPECIALTIES, INC.

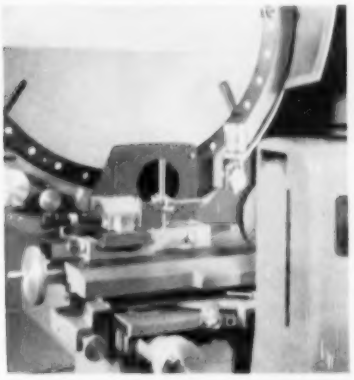
2100 South Laramie Avenue
Chicago 50, Illinois



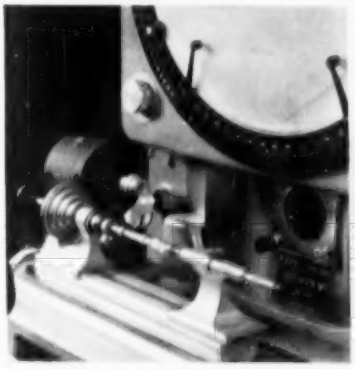
1. Cross section through pressure control valve body shows tricky inspection problem. There are 12 linear and 8 angular dimensions to be measured within the hole shown in cutaway.



2. Part of the receiving inspection department of the aircraft components plant. Model 30 Contour Projector is at the left. Operators work comfortably in normal lighting.



3. Close-up of Model 30 shows tracer fixture and pantagraph. The tracer fixture follows the contours of the hole and translates them into an image on the screen for accurate gaging.



4. In another application, a Kodak Contour Projector, Model 4, is used with a jeweler's lathe, which enables the operator to grind the radii on a servo mechanism piston to a tolerance of .0005" by watching the magnified image during grinding.

2/3 cut in gaging time

helped prove how 23 more Kodak Contour Projectors would return their cost inside 12 months

A leading manufacturer of aircraft components recently purchased 23 Kodak Contour Projectors when cost studies showed the machines *would pay for themselves in 12 months.*

The studies were based on the time and labor saved by Kodak Contour Projectors in inspection of parts like the pressure control valve body pictured above.

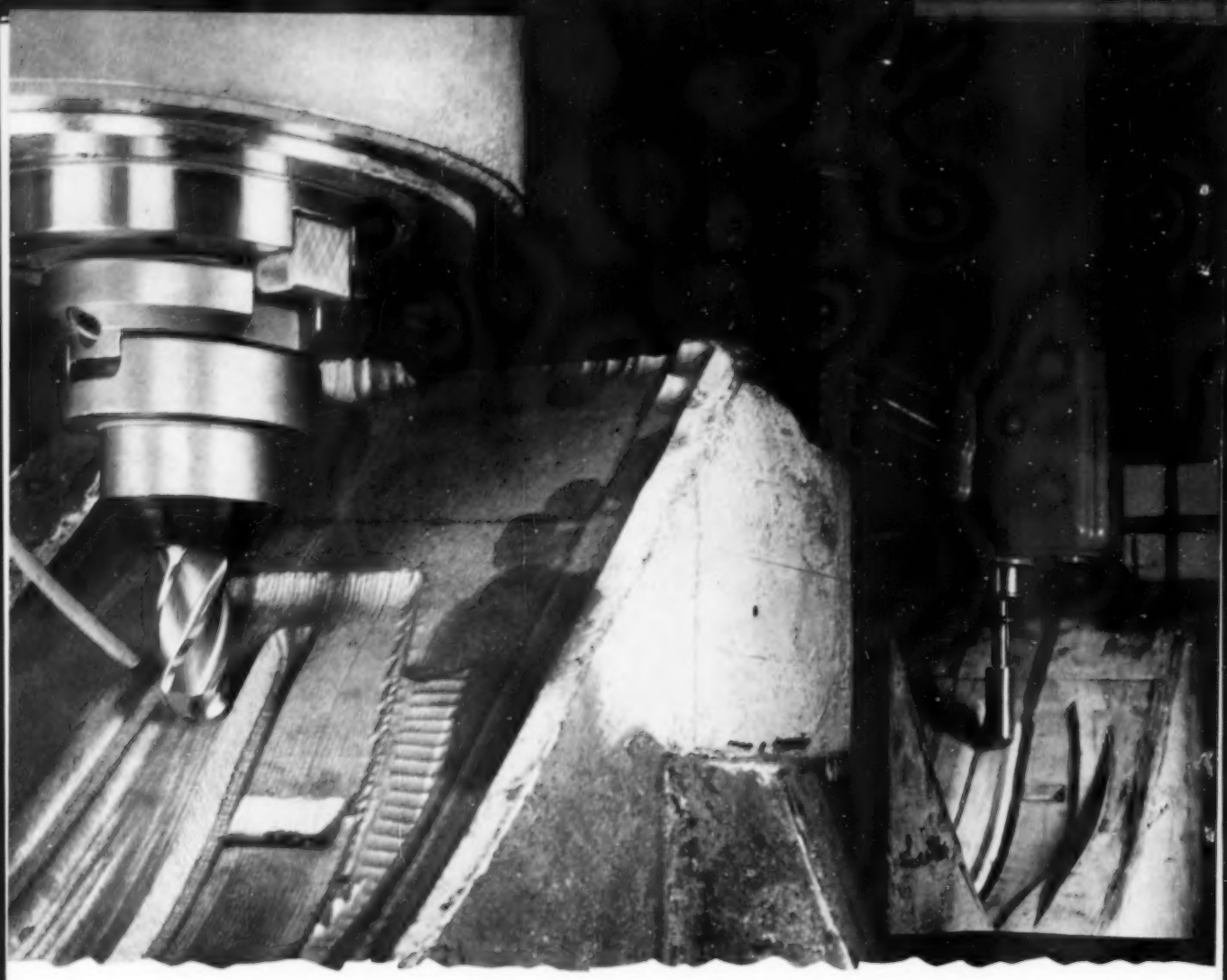
This component has 12 linear and 8 angular dimensions to be checked—*all inside a blind hole.* With a Kodak Contour Projector, Model 30, inspection of 25 pieces takes just 3½ hours. Formerly, the same job took 10 hours and was less accurate. Hundreds of manufacturers across the country have had similar experiences with all sorts of complex parts, large and small.

Whether your problem involves receiving, production, or final inspection, there's a Kodak Contour Projector to do the job quickly, accurately, and at low cost. To learn more about how optical gaging can work for you, send for your copy of the free booklet "Projection Gaging with Kodak Contour Projectors," or write for the name of the representative in your area. No obligation, of course.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.
Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK



EFFICIENT MILLING...*in any direction!*

New CLEVELAND 4-flute center cutting End Mills reduce individual end tooth shock and assure smoother cutting action, particularly in plunge milling.

The advanced design of 4-flute 500 Series High Speed End Mills is your assurance of *accuracy* and *high production* in both tracer and general purpose milling. The accurately form-ground notches and the precision ground cutting edges give you absolute uniformity and *positive chip removal.* Try these new CLEVELAND End Mills on your next job. Get all the advantages of 4-flute mills *and plunge cutting, too!* Contact our nearest Stockroom, or . . .

BALL NOSE SQUARE END

In both the ball nose and square end types, the rake angle is uniformly progressive from zero at dead center to blend with the hook in the cutting face of the flutes.

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

Talking About Die Sets

with
Phil Marsilius
Vice-President
The Producto Machine Co.

Master or Commercial: What Makes the Difference? The most obvious difference between a Master (Precision) set and a Commercial set is the price. The Commercial set costs less because less assembly time is required in its manufacture. Punch holder and die holder tolerances are the same for both grades of die set. However, extremely close tolerances for fit between pins and bushings on Master sets require more accurate honing of bushings in assembly. Master die set tolerances for parallelism between punch and die holder are also more critical than those for Commercial die sets.

Normally, the difference between pin and bushing diameters on die sets manufactured by our industry is never less than .0002" and ranges as high as .0009". There are die sets made to closer or looser tolerances than these, but generally speaking, the majority of die sets fall into this category.

Master die sets are manufactured to the low side of this tolerance scale and are held to a maximum of .0004" differential. This closer tolerance increases the useful life of precision sets by allowing for wearing of the pins and bushings in operation.

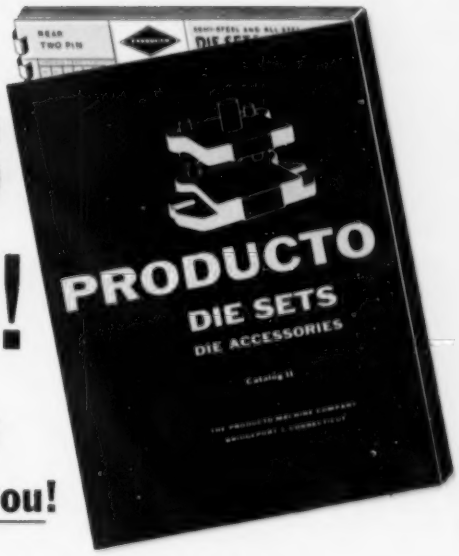
Commercial die sets are made throughout the entire range of this tolerance scale and, more often than not (to reduce assembly cost), are made to the higher tolerances. As a result, their accuracy will usually decrease much faster than that of Master die sets. While it is possible with this tolerance range to receive a Commercial set with the minimum pin and bushing fit allowed, you can be certain of longer die set accuracy only with a Master set, which is guaranteed to be held to the low side.

A "free-sliding fit" is one that permits the punch holder to move down on the guide pins of its own weight. It does not have any bearing on the degree of accuracy of the die set since a free-sliding fit can be supplied on both Master and Commercial sets. On Master sets, however, it is sometimes necessary to hone out the bushings to a full .0004" tolerance to provide a free-sliding fit.

EVERY die set MUST, of necessity, work freely in normal use, *on the press,* but catalog die sets should come apart and go together easily for bench work. With an occasional exception (when sets are made to the lowest tolerance for fit allowed), disassembly should be possible by hand without use of separating tools.

In making a choice, the degree of accuracy required and the life requirements of the die set should be the main points of consideration which determine whether you should order a Master or Commercial die set.

IT'S HERE!



A new catalog designed for you!

WRITE FOR YOUR COPY TODAY

Here, at last, is a die set catalog that makes your selection and ordering really easy. Producto's all-new catalog is compact for the die designer, convenient for the purchasing agent, a functional tool for the die maker.

These unique features make Producto's catalog much easier for you to use:

IT'S COMPACT. Though many items have been added, it has *fewer* pages because superfluous material has been eliminated. New products include Qwik-Fit Guide Pins, new Bushings with grease fittings, Lamina Bushings, Ring Punches and Dies, Toolroom Equipment, Lubrication Accessories and new Die Spring Selections.

IT'S COMPLETE, containing the greatest selection of die sets and accessories that has ever been offered to date.

ALL PRICES ARE NET and appear in a *separate pricing supplement,* removed from the technical section. No more time-consuming "discount" calculations.

NEW BINDING ARRANGEMENT lets you look at technical and pricing information *simultaneously.* No more flipping pages back and forth to get complete information.

STREAMLINED PAGE LAYOUT makes it easier for you to find essential data. Color highlights catalog numbers and drawings.

To make your die set ordering as painless as possible, write today for a free copy of Producto's new Catalog No. 11.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut

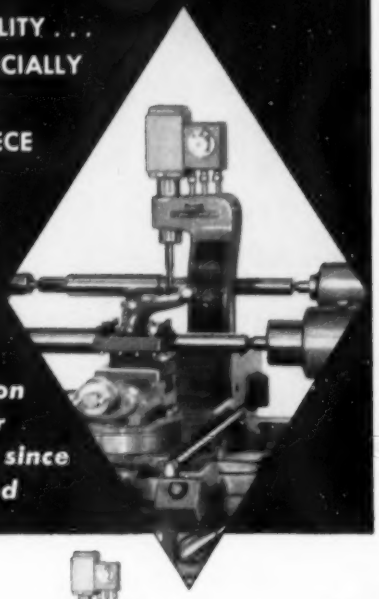
Wherever die sets are used
PRODUCTO
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

Truly Sensational!!

IN SIMPLICITY . . . VERSATILITY . . .
PRECISION-ACCURACY . . . ESPECIALLY
IN SAVINGS IN COST
PER FINISHED PIECE

SIDNEY
FLUID TRACER

The finest precision duplicating attachment ever offered to industry since cutting tools were invented



INSTANTLY . . . precisely and in any desired quantity (no matter how small or extended a run) every change in contour is transferred from master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

Changeover to standard lathe operation or back to tracer work requires only a few seconds without the addition or removal of any parts.

Model 32 Dial-Master Sidney Engine or Tool Room Lathe with Sidney Fluid Tracer

THE SIDNEY MACHINE TOOL COMPANY
over 50 years
of service to
AMERICAN INDUSTRY
SIDNEY • OHIO

30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 . . . used regularly as a standard SIDNEY feature ever since. But only recently adapted by other lathe manufacturers . . . a fitting tribute to SIDNEY pioneering and leadership.

THE SIDNEY FLUID TRACER is remarkable! It saves time and costs and increases production.

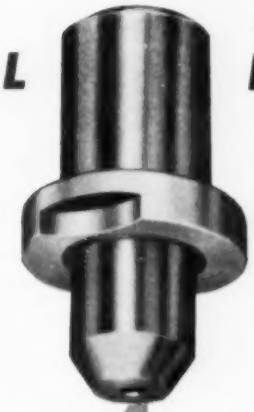
Write for bulletin or ask for representative to call at your convenience.

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

locate RIGHT ON THE NOSE!

WITH UNIVERSAL LOCATING PINS



The accuracy of Universal Locating Pins assures you quick, accurate alignment in production operations. They are hardened and ground and held to close tolerances. All standard sizes—of round or relieved—in press fit, threaded or lock screw types including rest buttons are stocked and available for immediate delivery at a fraction of the cost of ordinary tool-room pins. Write today for new 98 page catalog showing the complete line of Universal quality products.

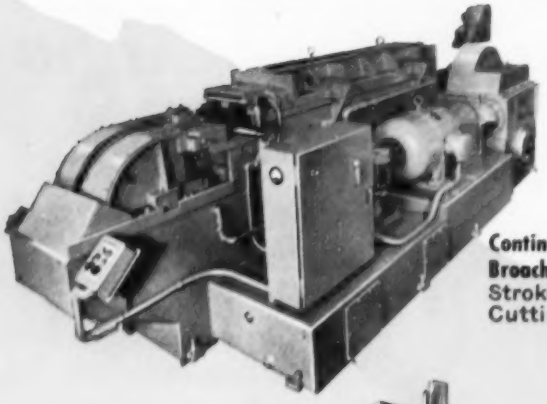
UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 3, MICHIGAN

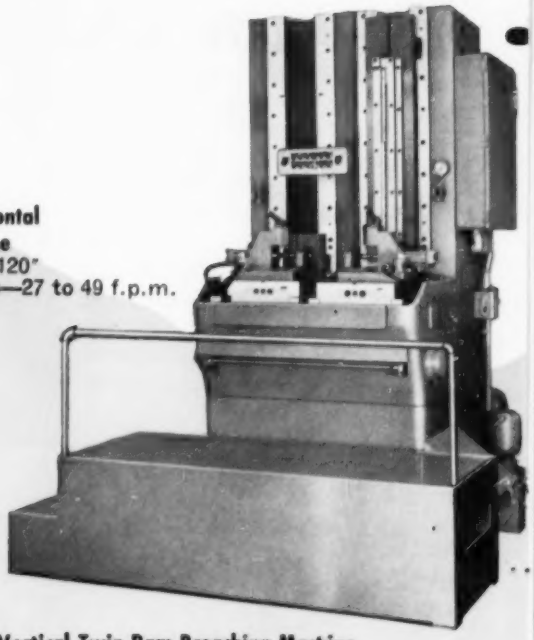
194

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-41

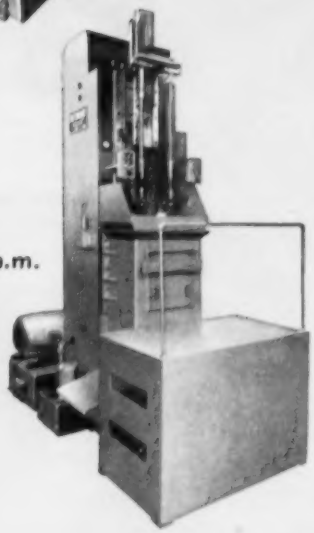
Your Best Investment
and Tomorrow's
for Today's Production



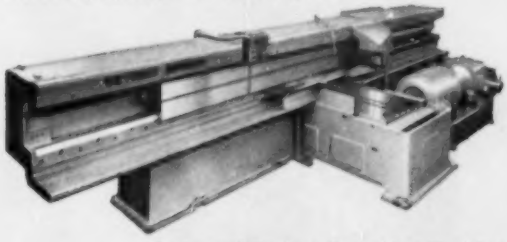
Continuous Horizontal Broaching Machine
Stroke—42" to 120"
Cutting Speeds—27 to 49 f.p.m.



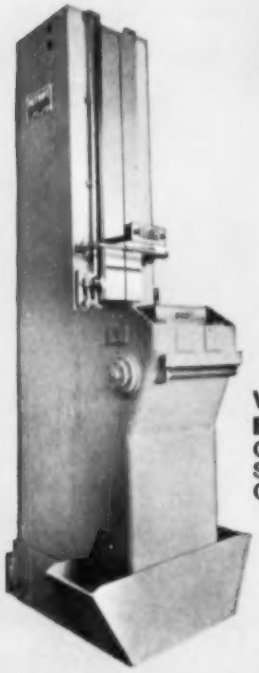
Vertical Pull-Down Broaching Machine
Capacity—5 to 50 tons
Stroke—30" to 72"
Cutting Speeds—4 to 35 f.p.m.



Vertical Twin Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30" to 100"
Cutting Speeds—4 to 35 f.p.m.



Horizontal Surface Broaching Machine
Capacity—10 to 50 tons
Stroke—90" to 240"
Cutting Speeds—15 to 300 f.p.m.



Vertical Single Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30" to 90"
Cutting Speeds—4 to 35 f.p.m.

Horizontal Internal Broaching Machine
Capacity—3 to 50 tons
Stroke—6" to 90"
Cutting Speeds—4 to 35 f.p.m.

NOTE—All capacities, strokes and cutting speeds given are for standard machines and will be varied to suit your requirements.

Requirements

. DETROIT Broaching Machines

You want machines for *today's* production to be rugged . . . built to deliver high output consistently, without costly shutdowns. *But look to the future as well!* Be sure that these machines are also designed with maximum versatility . . . so they'll be readily adaptable to model changes for *tomorrow's* production, too.

Detroit machines meet these requirements because they are:

- **RUGGED . . . take overloads 50% over rated capacity.**
- **FLEXIBLE . . . easily retooled for part or model changes.**
- **DEPENDABLE . . . rigid construction and stabilized hydraulic circuits assure consistent high production.**
- **SIMPLE . . . easy to operate, easy to maintain.**
- **VERSATILE . . . available with manual, semi-automatic or full automatic control plus automatic tool handling.**
- **PRECISE . . . total ram runout less than .0005" through strokes as long as 100".**
- **FOOLPROOF . . . full interlocking protects machine and tooling. All electrical and hydraulic equipment to J.I.C. standards.**

To make the best investment for today *and* tomorrow, consult our Engineering Department. They'll recommend the right high-capacity, high-performance Detroit machine to solve your problem, along with complete tooling and automation if required. Send parts, prints or details of your problem now.

(Ask us to quote on any of your hydraulic press applications.)

DETROIT BROACH

& MACHINE COMPANY

DEPT. D-3

ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

DETROIT BROACH & MACHINE COMPANY
DEPT. D-3, ROCHESTER, MICHIGAN

Please send me free literature on:

- ☐ Continuous Horizontal Broaching Machine
- ☐ Horizontal Surface Broaching Type
- ☐ Single Ram Vertical Type
- ☐ Twin Ram Vertical Type
- ☐ Pull-Down Vertical Type
- ☐ Broaching Tooling
- ☐ Presses

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

BARNESDRIL #2 Magnetic Separator installed on a cylindrical grinder.

BARNESDRIL ..... coolant separator increases production 15%

pays for itself in less than 9 months

Automatically separating ferrous particles from coolant with a #2 Barnesdril Magnetic Separator and recirculating it, has produced a saving of $20.00 per week* on this cylindrical semi-automatic grinder

Benefits such as improved finish, less downtime and less coolant waste were immediately noticeable. Additional benefits, such as the reduction of dermatitis and increased operator comfort, were noted only after the coolant separator was in operation some time.

These benefits are typical of the savings and benefits accrued when a Barnesdril separator is installed. Call your Barnesdril Factory Representative today or write for Catalog 350.

Congratulations To ASTE On Their 25th Anniversary

*** SAVINGS PER WEEK:**
- 3¼ hrs Cleaning Time
- 3¼ hrs Operator's Time
- 1.87 gals. Coolant
- 25% Wheel Life

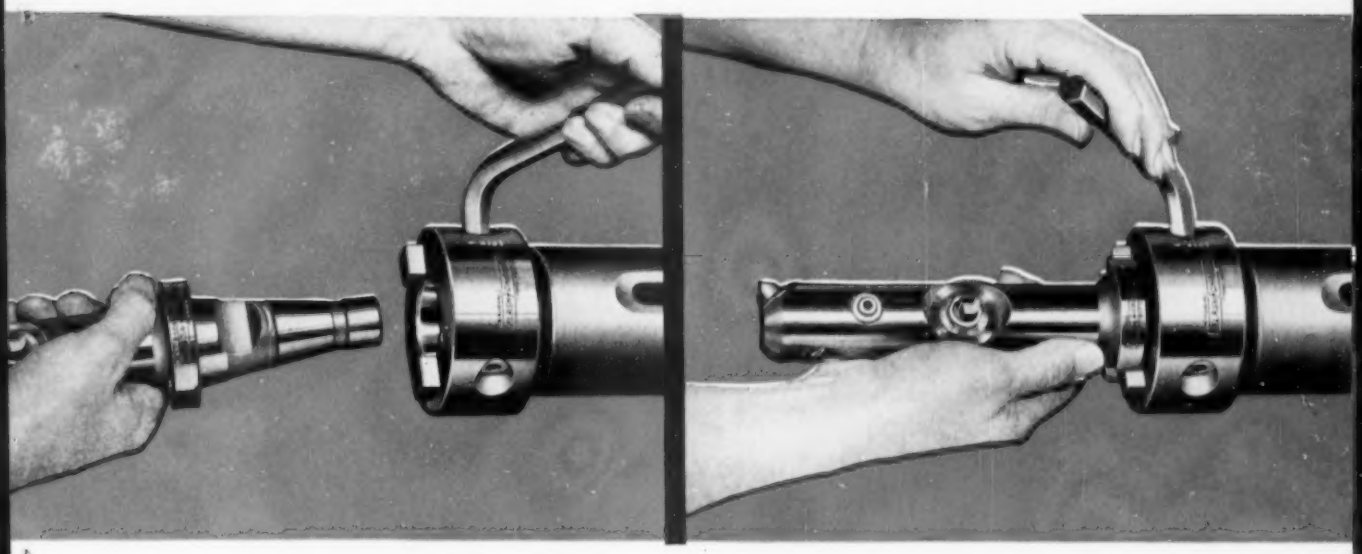
FILTRATION DIVISION

50th year

BARNES DRILL CO.

870 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

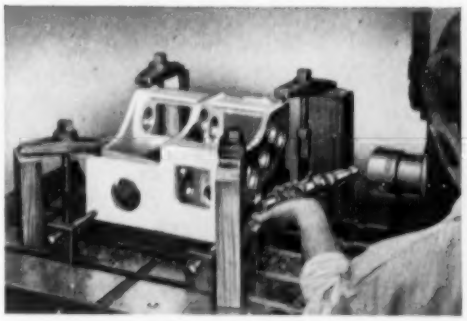
change tools in seconds!
retain exact diameter settings . . .



WITH MICROBORE FLASH-CHANGE SYSTEM!

Flash-Change permits a boring bar, set to a specific bore diameter, to be changed in seconds for other machining operations. Again and again, the bar can be quickly repositioned in the machine to accurately duplicate the original operation without further adjustment.

Flash-Change tooling includes a complete range of boring, drilling and milling equipment readily adaptable to any machine, or from one machine to another, by means of a simple Flash-Change Tool Holder with driving shank to suit the machine spindle. In addition to Flash-Change, the Microbore System includes a complete range of Standard Boring Bars. Special Cluster Bars can be furnished upon receipt of a part print and engineering data.



Shown is a cast iron gear box machined with Flash-Change tooling on a production basis. Production time substantially reduced. Bore diameters duplicated to extremely fine limits.

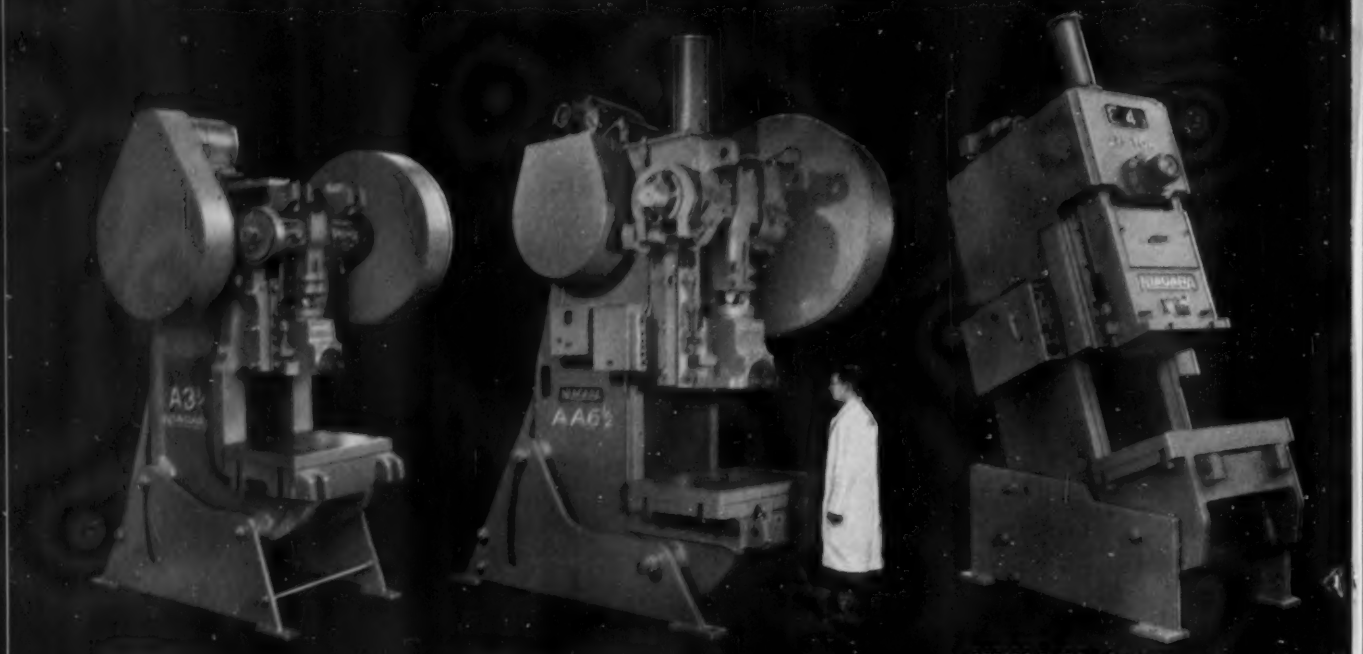
For complete information on a tool system that can greatly increase your production standards and profits, write for Catalog No. 57.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

NIAGARA HAS THEM!

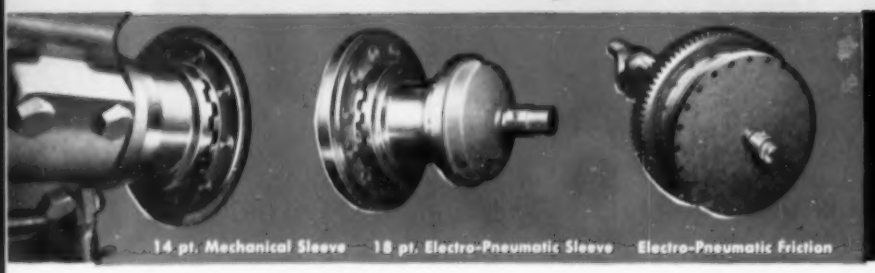


SERIES A, 5 ½-110 tons

SERIES AA, 32-200 tons

SERIES E, 75-200 tons
Front-to-Back Crankshaft

READILY EQUIPPED TO HANDLE



14 pt. Mechanical Sleeve — 18 pt. Electro-Pneumatic Sleeve — Electro-Pneumatic Friction

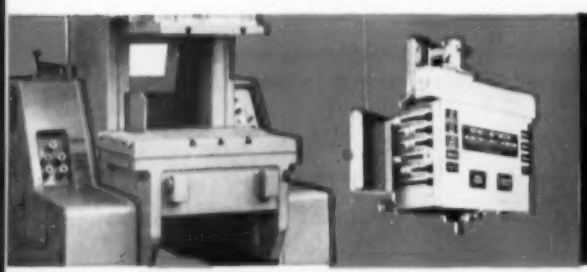
Single Cylinder — Tandem Type

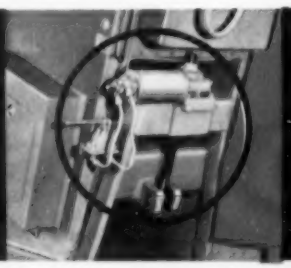
THREE TYPES OF CLUTCHES

Each Niagara Inclinable features the clutch best suited for the purpose. (1) Famed Niagara multi-jaw mechanical sleeve clutch. (2) Exclusive Niagara multi-jaw Electro-Pneumatic sleeve clutch. (3) Niagara low inertia Electro-Pneumatic friction clutch.

FOUR TYPES OF DIE CUSHIONS

Designed and manufactured by Niagara, single cylinder and tandem type pneumatic die cushions are built in 4 types to make any Niagara Inclinable a double action press. Self-lubricating models are available for automated OBI's.





SPECIAL BOLSTER PLATES
J.I.C. CONTROLS FLANGED SLIDES
POWER SLIDE ADJUSTMENT
FLYWHEEL BRAKE
DIE AREA LIGHTING
MOTOR CUTOUT SWITCH

EQUIPPED FOR AUTOMATION

Featuring the most advanced controls and devices, Series EA (automated models) are engineered for peak productive capacity. Here's a line of OBI's that is completely equipped by Niagara for operation in your automation lines.

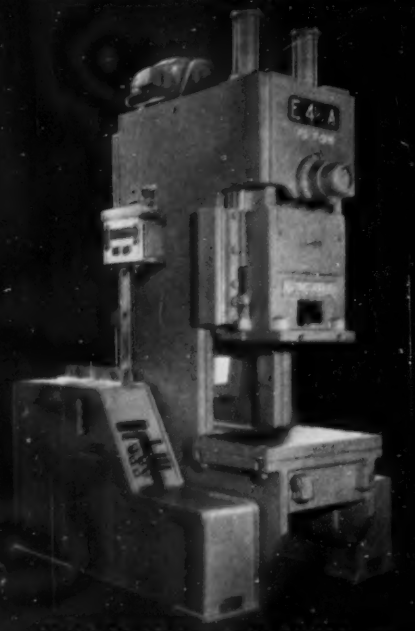
POWER INCLINING DEVICE

Fast-acting, safe and easy to operate, Niagara's air motor inclining device (shown above) is furnished as an optional accessory.

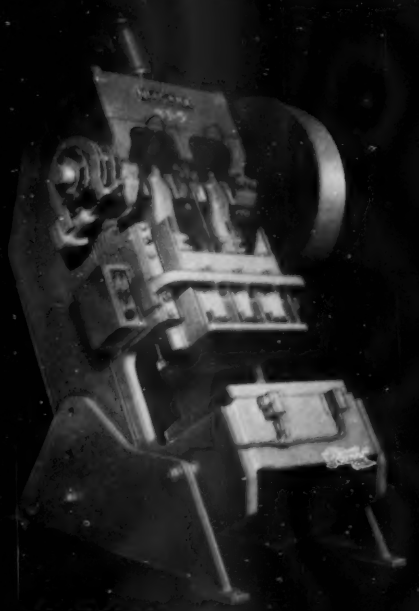
WIDE CHOICE OF ACCESSORIES

With a full selection of modern press accessories available, Niagara Standard Inclinables are adaptable to the widest possible range of job assignments.

standard OBI presses in all sizes and types that are right for you!



SERIES EA (Automated), 75-200 tons
Front-to-Back Crankshaft

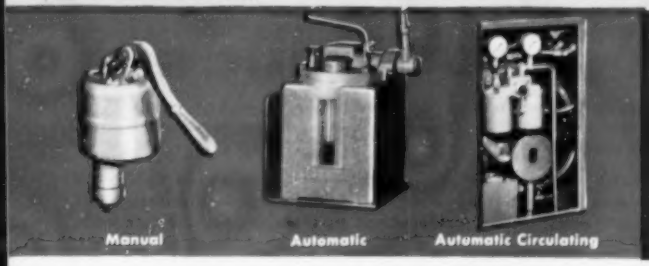


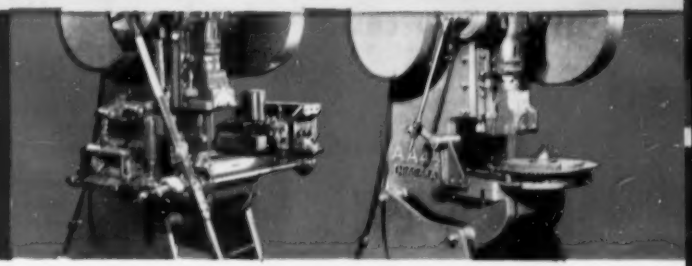
SERIES BI, 60-200 tons
Double Crank

5 LINES . . . 34 MODELS
EACH A CHAMPION IN ITS CLASS

Niagara offers you industry's most complete, most modern, and most exclusive selection of standard inclinables . . . plus an unequaled choice of press accessories and automatic devices to meet your specific job requirements. You can count on Niagara for inclinables that will do the most to speed production, assure accuracy, prolong die life and hold down maintenance costs within your plant.

YOUR WORK MOST PROFITABLY





CENTRALIZED LUBRICATION TO FIT THE NEED

Niagara Inclinables are readily equipped with either manually-operated or automatic lubricators, or automatic circulating oil systems. It's one of the many ways in which Niagara outfits standard inclinables to meet individualized requirements.

ALL TYPES OF AUTOMATIC FEEDS

To speed production, Niagara Inclinables are easily equipped with complete, automatic feed arrangements: single roll, double roll, dial, chute, magazine and specially engineered types. Variable speed drives can be provided to allow adjustment for the optimum speed consistent with the die, material and feed length.

NIAGARA

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

GET ALL OF THE FACTS on any or all Niagara Inclinable Presses. Consult with a Niagara representative. His recommendation will be impartial. He has all types of OBI's to offer. At your request, specific Bulletins on each series, containing complete information and specifications, will be mailed to you promptly

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES:

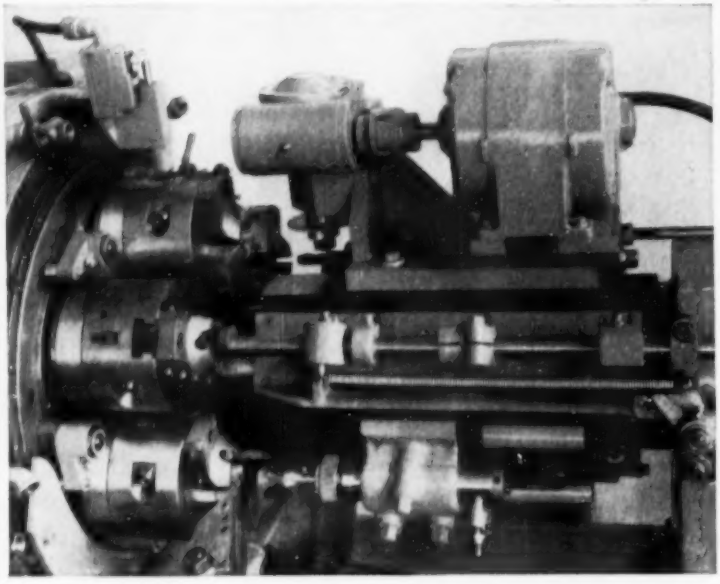
Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries

...ask BAIRD about it

DRILL • BORE • REAM • RECESS • FORM RADIUS • MILL SLOT

44.5 seconds per piece



It pays to combine hard-to-handle operations on a versatile BAIRD 76H CHUCKER

industry's most versatile high production chuckers

A glance at this photograph will show you how straightforward and "clean" the arrangement is. Yet a wide variety of operations is being performed to close tolerances on a difficult workpiece.

A unique feature is the milling of the locating slot in the direct center of the part. The milling is accomplished by stopping and accurately locating the chuck. This locating slot is used on all subsequent operations on other machines. The forming of the shape on the lead of the hole, plus the grinding relief, is done by a combination slide with a form tool.

The outer face is machined from the cross slide, which incorporates a relieving motion to eliminate draw-back marks.

Sequence of Operations: Drill, bore and ream .735 - .739 center hole, face end, recess back of center hole for grinding relief, form radius on open end of hole (combination slide), and mill .1875 ± .001 locating slot.

Production: Cycle time 44.5 seconds per piece, 80 pieces per hour gross.

Every manufacturer who has installed Baird Automatic Chuckers knows them as rugged, dependable producers of amazing versatility . . . easy to re-tool when the job changes. We'll be glad to estimate and give our recommendations on your prints or samples. Write Dept. TE.

Interested in Deferred Payment? . . . "ask Baird about it."

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

THE BAIRD MACHINE COMPANY

STRATFORD CONNECTICUT

68A56

PRECISION-PREPARED

TOOL STEEL FLATS AND SQUARES

for tools...dies...precision parts

Warplis

OIL HARDENING

GROUND FLAT STOCK

Carbon .90% Manganese 1.10%
Chromium .50% Tungsten .50%
Vanadium .15%

Generally regarded as the finest of its type . . . the most versatile and adaptable for the widest range of purposes.

"Pittsburgh"

AIR HARDENING

GROUND FLAT STOCK

Carbon 1.00% Manganese .50%
Chromium 5.25% Molybdenum 1.10%
Vanadium .25%

5% chrome type . . . offers superior toughness and wearability for long-run or out-of-the-ordinary applications.

Also precision-prepared oil hardening, water hardening and high speed drill rod rounds . . . water hardening flats and squares . . . cold finished fine steels in all sizes, grades and shapes.

These fine steels—tops of their type—are first national favorites for ease of working . . . for excellent hardness and toughness without warpage or dimensional change . . . for dependable performance. Precision preparation ensures satin-smooth and decarb-free surface, close accuracy, truly square corners, flat and parallel sides.

With fine steel thus prepared none of the time and talent of the skilled worker need be spent on get-ready—no metal wasted. Procedures may be simplified . . . quality controlled . . . work speeded . . . time and money saved.

Warplis oil hardening comes in the complete range of 651 standard sizes; "Pittsburgh" air hardening in 252 standard sizes.

Each piece is indelibly name-branded . . . each comes in its own protective wrapper bearing size, brand, analysis, and heat treatment.

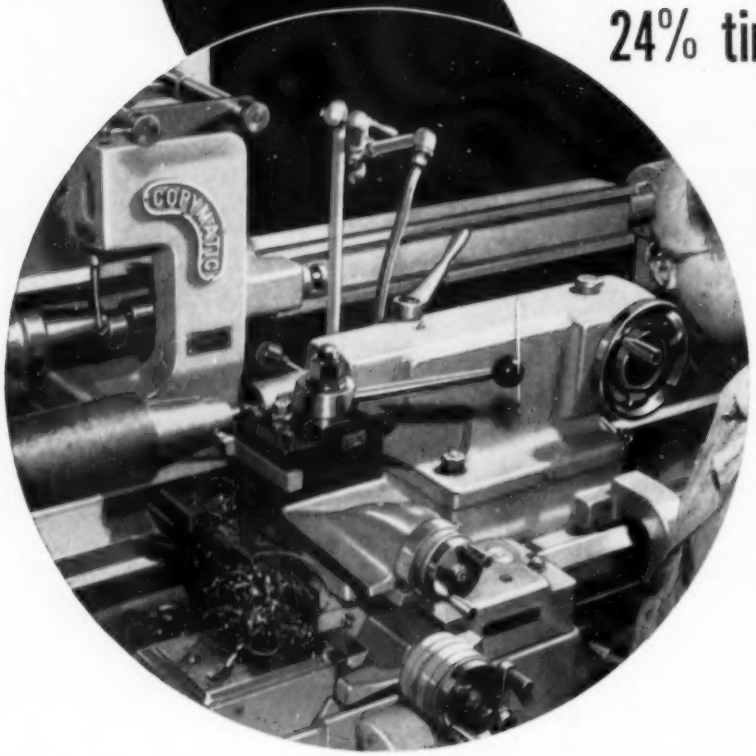
The size and grade of your choice is conveniently obtainable from selected distributors coast-to-coast. Order by name . . . or ask us for complete information.

PITTSBURGH TOOL STEEL WIRE CO.

MONACA, PENNA.

straight from the horse's mouth:

..."a very good machine... 24% time saved!"



When a famous machine tool manufacturer reports on the performance of another's product, it is an opinion you can count on as authoritative.

The Ingersoll Milling Machine Company of Rockford, Illinois is one of the early owners of a new Lodge & Shipley 16" POWERTURN 90° COPYMATIC Lathe. Used in turning cutter housings and shanks, shafts and spindles, the lathe has proved very good, judged on performance, construction, accuracy and versatility.

If you want eye-witness proof of similar significant savings on your lathe production, the Lodge & Shipley Demonstration Room is at your service. Contact your Lodge & Shipley distributor for details or write direct to: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

JOB FACTS

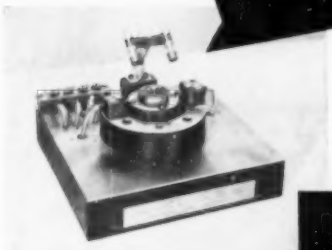
WORKPIECE: 4" Diameter Cutter Housing
OPERATION: Turn complete including taper
MATERIAL: 4140 HR Steel
CUTTING TOOLS: Carbide
FEED: .018" per rev.
SPEED: 431 RPM
TIME: Floor-to-Floor: approx. 35 min.
RESULTS: 24% time saved

Lodge & Shipley

Speed Inspection
OF PRODUCTION PARTS!

NEW **DEARBORNAIRE**

MULTIPLE COLUMN AIR GAGING INSTRUMENTS



Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.

Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.

To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

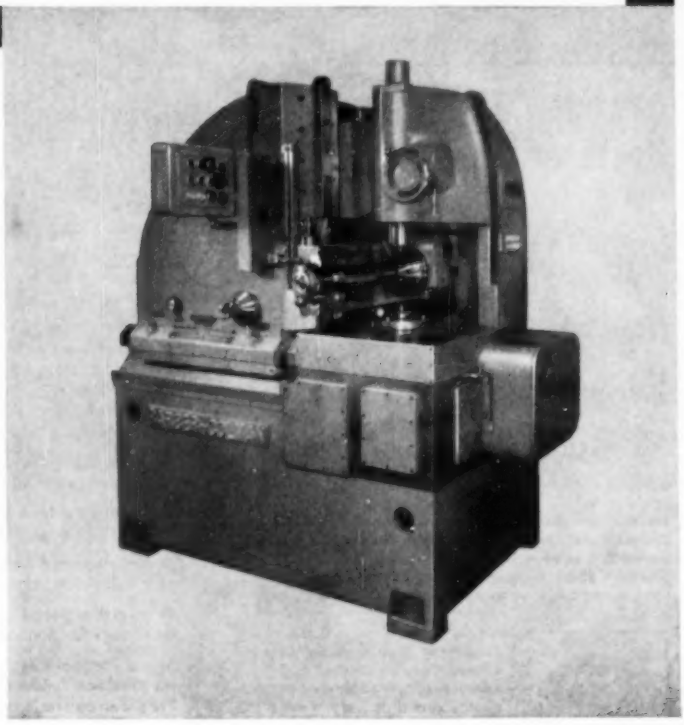
Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!

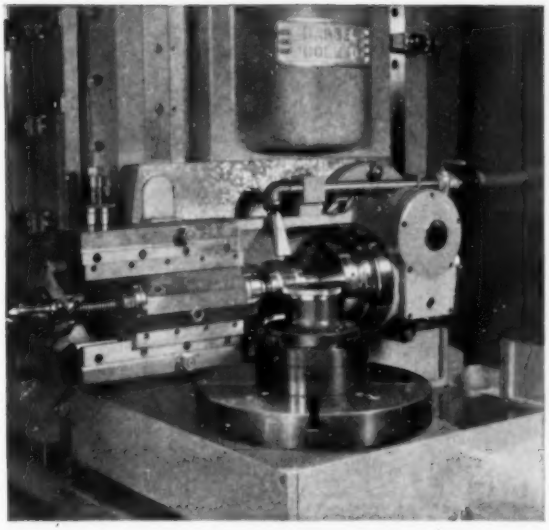
AIR GAGE DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

a new concept of gear accuracy!

Barber • Colman Builds World's Most Accurate Hobbing Machine

First hobbing machine ever guaranteed to cut gears within 10 seconds angular error





Barber-Colman has designed and built, in collaboration with Sperry Gyroscope engineers, a new type of hobbing machine which hobs without any further finishing operation, gears for the most accurate radar, navigational and computing equipment. This machine is known as the "Ultracision" Hobbing Machine and is so accurate that gears cut by it will transmit motion within 10 seconds of true angular rotation. This is equivalent to .0001" on 4" diameter, which is the only size that has been thoroughly investigated at the present time. This means that the combination of lead, profile and spacing errors measured over non-adjacent teeth cannot exceed 10 seconds of true angular displacement at any diameter along the involute.

In order to arrive at this degree of precision, it has been necessary to provide new methods of positively checking such accuracy. Sperry engineers utilize theodolites and auto-collimators in conjunction with pneumatic, electronic and mechanical gaging equipment which assures accurate measurement within millionths of an inch.

the machine

To produce gears of this accuracy, many new and unusual features have been incorporated in the hobbing machine. The greatest care in manufacture and assembly has been used for all parts. All vital surfaces on the machine are scraped within .0001" per foot, and even the covers are scraped to fit the scraped portions of the bed casting to prevent entry of foreign matter.

Since the machine is designed to cut only spur gears, the feed drive is independent of the main drive. Capacity of the machine is 10" diameter blanks, 6" maximum length of hob carriage travel, and maximum rated pitch capacity of 32 DP. Drives to the work and hob spindles have been made as short as possible to minimize any twisting and vibration. An extremely accurate index worm and gear are mounted in ultra-precision taper roller bearings. Except for the index change gears, the gear train between the main drive shaft and the index worm contains only a worm and worm gear, and a pair of 90° helical gears.

The basic machine weighs 11,000 lbs., (with controls 13,800 lbs.) to provide the rigidity necessary for this exceptional accuracy. Another feature for increased rigidity and accuracy is the elimination of a hob slide. The hob is mounted directly on an expanding arbor, and shifted on this arbor, rather than by means of a hob slide.

Adjustments are provided for trueing the hob spindle within a few millionths of an inch. Both hob spindle and outboard support are mounted in ultra-precision taper roller bearings.

the hobs

To attain extreme profile accuracy on the gear teeth, Barber-Colman also has developed a new class of hob called "Ultracision", and made to limits of .00008" lead variation in one axial pitch, and .00015" in 3 axial pitches. These limits are just half of those for Class AA hobs. These hobs are ground and have larger than standard diameters to permit a greater number of hob teeth for very fine finish on the gear tooth profiles. Wide hubs and a 2" diameter straight bore provide maximum rigidity for the hob.

The development of this new concept in gear accuracy — the finest limits of gear accuracy ever obtained on a production basis — will eventually reflect in a higher standard of quality for gears produced on standard production hobbing machines. You are invited to submit your gear specifications and problems for analysis and recommendations by our engineers. Detailed information on the new "Ultracision" Hobbing Machine is available on request.

BARBER-COLMAN COMPANY

683 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

Use MANHATTAN ABRASIVE WHEELS for Faster Cutting and Grinding . . .

Whatever your needs, a Manhattan Abrasive Wheel can be engineered for your particular alloy requirements. Manhattan Abrasive Wheel Specialists help solve problems at *your* plant, for faster cutting, rough grinding or finishing. Every component of the wheel they specify—abrasive, grain size, hardness, structure and bond—is custom-designed for your working conditions to remove *more* metal, *faster* . . . at *lower* cost.

ROUGHING WHEELS • FINISHING WHEELS
CUT-OFF WHEELS • MOLDISCS • DIAMOND WHEELS for

Foundry Snagging—Billet Surfacing
Centerless Grinding
General purpose grinding with portables
Grinding and Finishing stainless steel welds
Bearing Race Grinding and Finishing
Finishing Tools and Cutlery
Cutting-off—Wet or Dry—Bars, Tubing, Structurals, etc.
Foundry Cutting—standard and reinforced wheels
Grinding Carbide Tipped Tools

Discuss your metal removal requirements with a Manhattan Abrasive Wheel Specialist. He'll show you how you can get more output per man hour . . . "More Use per Dollar".

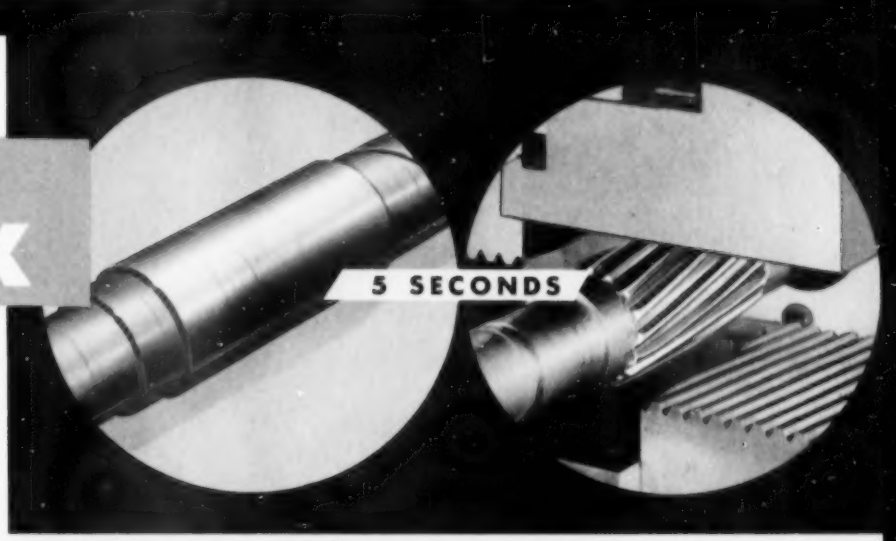
WRITE TO ABRASIVE WHEEL DEPARTMENT
MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

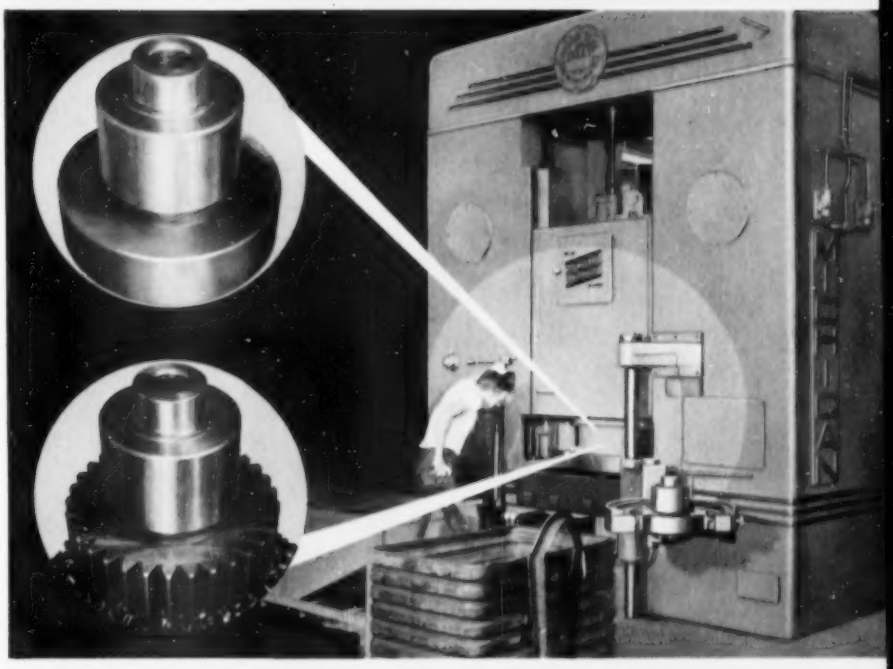
This Month's

GEAR PIX



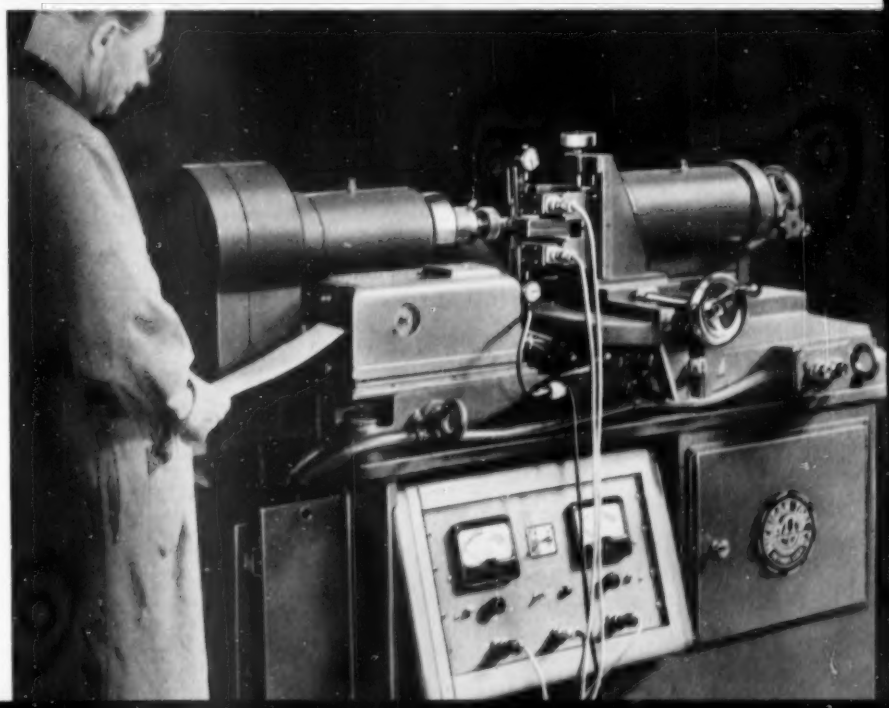
SPLINE ROLLING IN ONLY 5 SECONDS . . .

. . . That's all it takes to roll-form this helical spline with the Michigan Roto-Flo "chipless production" process. Floor-to-floor time, with automatic loading, is 17 seconds. Cold metal displacement produces required dimensions from blank diameters less than the PD and OD. As accurate as machining, the process produces superior surface finishes. Want more data? Just ask for our application Bulletin RF-55.



GEARS FOR ROADBUILDING EQUIPMENT . . .

. . . are readily cut on this automatically cycled Michigan Shear-Speed. The heavy 33-tooth gear shown (3¾-in. face width) is produced at 5½ pieces per hour, removing over 10 lbs. of SAE 8622 steel as chips. Cutting speed is 17 fpm. Let us send you Bulletin SS-55 telling the full story of large gear shaping.



AUTOMATIC CHECKER FOR HIGH PRECISION GEARS . . .

. . . designed particularly for aircraft and special-purpose spur gears. Cuts time needed for checking and recording parallelism, tooth taper and tooth spacing to 16% of normal. Handles gears from ¼ to 2½-inch face width and up to 14 inches diameter. Readings are automatically and permanently recorded by a built-in recorder for easy comparison. Ask for Bulletin 481-A.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

This Month's

GEAR PIX

AUTOMATIC LOADING UPS GEAR SHAVING OUTPUT . . .

. . . and releases the operator for preliminary gear checking. Mechanical loaders on standard machine tools (shown here: a Michigan Gear Shaver) offer a middle ground of automation that pays off immediately in output per machine-hour without increasing the work load of the operator. It's also safer.

READY SOON— A TANDEM HOBBER . . .

. . . latest addition to the Michigan line of hobbers features self-contained checker, automatic size control, loading and unloading, and chip disposal. You'll be able to set two or more of these hobbers in series for continuous through-feeding of parts. Literature coming off press soon—drop us a line now.

FROM RESEARCH— BETTER MACHINES, BETTER GEARS . . .

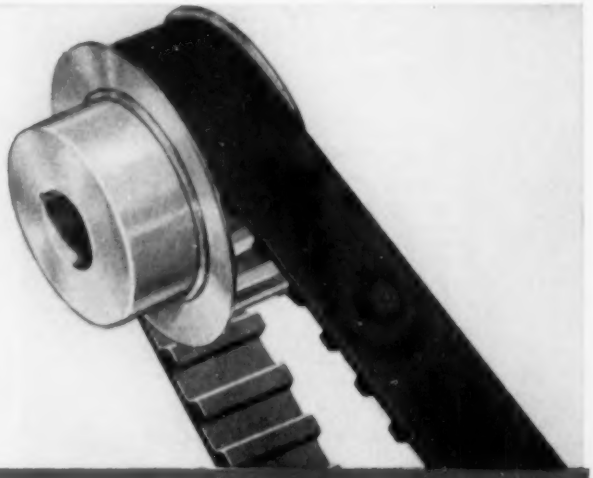
. . . Michigan machines and tools of tomorrow—for the controlled-quality, easier-made gears and splines to come—will owe much to the work of our research staff. This stepped-up development activity, now housed in new facilities (one section of which is shown), will carry on the scientific study basic to gear progress. New methods, machines and tools are sometimes the best answer to requirements of a particular manufacturer. If you have a problem in the area of gear and spline production, we will be glad to talk it over.

MICHIGAN TOOL COMPANY

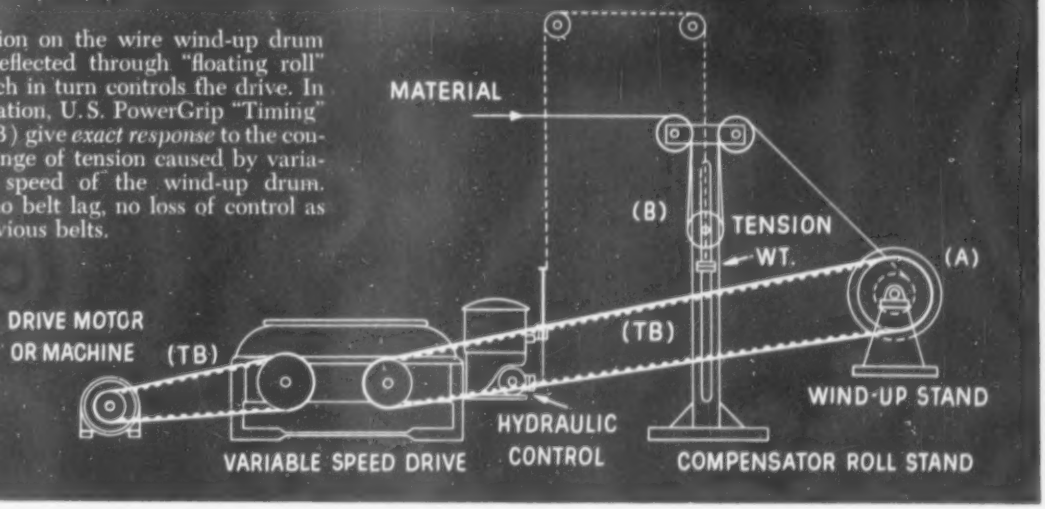
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

US RUBBER *PowerGrip "Timing" Belts*

How a designer licked the wind-up problem in a highly sensitive machine



The tension on the wire wind-up drum (A) is reflected through "floating roll" (B) which in turn controls the drive. In this operation, U.S. PowerGrip "Timing" Belts (TB) give *exact response* to the constant change of tension caused by variations in speed of the wind-up drum. Hence, no belt lag, no loss of control as with previous belts.



The schematic drawing illustrates a "floating roll," one of the most sensitive and precise methods of controlling tension in a web of material—whether it be wire, paper, cotton, threads, plastic or strips of metal. It is one more example of U.S. PowerGrip "Timing"® Belt's ability to simplify and improve a power transmission unit . . . one of the reasons why the invention of this belt was recently awarded the Franklin Institute's Edward Longstreth Medal for "Invention of High Order."

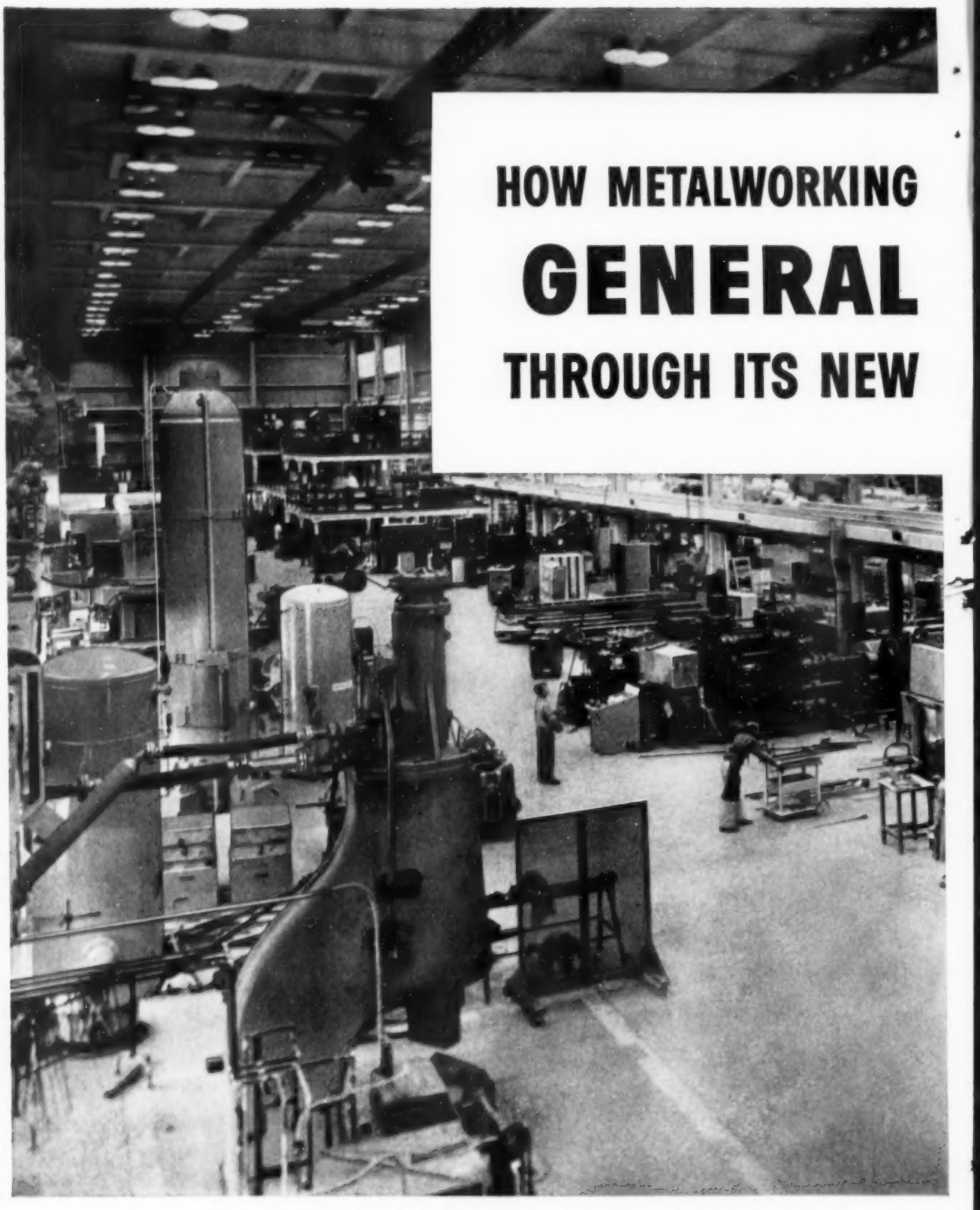
Whether for original equipment or plant conversion, U.S. PowerGrip offers all these advantages:

- *no slippage, no take-up—allows short centers, high ratios.*
- *absence of metal-to-metal contact—eliminates need for lubrication and housing devices.*
- *handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.*
- *close to 100% efficiency.*
- *imbedded with steel cables for high tensile strength.*
- *constant angular velocity.*

These belts—plus expert engineering service—are obtainable at "U.S." power transmission distributors, at any of the 28 "U.S." District Offices, or by writing us at Rockefeller Center, New York 20, N. Y.

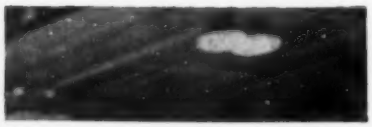
US RUBBER Mechanical Goods Division

United States Rubber



HOW METALWORKING GENERAL THROUGH ITS NEW

Laboratory with factory-size equipment—that's the new $5,000,000 G-E metals and ceramics laboratory in Schenectady. From here will come many of the products manufactured by the Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.



BENEFITS FROM THE RESOURCES OF

ELECTRIC

METALLURGICAL PRODUCTS DEPARTMENT

Solutions to your most pressing problems, plus developments ahead of industry trends, are now being worked out in our laboratories

It doesn't take a crystal ball to know what role cutting tools will play in the Metalworking Industry in the future. The signs are unmistakable.

More accurate casting, extruding, and forging techniques will mean that less metal must be removed by machining. And this will mean that cutting tools must take thinner cuts, and hold closer tolerances.

New and more automatic machine tools will mean that cutting tools must operate at higher speeds – yet provide the longer tool life necessary to give you maximum benefits from automation.

General Electric, through its new Metallurgical Products Department (successor to the Carboloy Department), has already developed several cutting tool materials that are ahead of these trends.

Three years ago, the first of the three Carboloy® Series 300 carbides was announced. Today, these grades permit you to cut harder steels, at higher speeds . . . at lower machining cost per part.

Two years ago, General Electric researchers introduced Cemented Oxide. This material puts mirror finishes on metal, while operating at speeds up to 3000 fpm – far beyond the range of carbides and ceramics.

And last year, G-E Engineers in the Carboloy Machinability Laboratory developed several new machining techniques to help you make better use of these improved materials. One of these techniques lead to a way to utilize carbides at low speeds – starting from 0 fpm – an almost impossible task until now.

All these developments resulted from the vast technological resources which General Electric has brought to bear on metalworking problems – plus the fund of machining knowledge accumulated since G-E first introduced carbides to American industry in 1928.

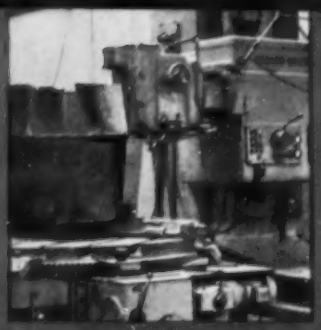
These resources and this knowledge mean that General Electric–through its Metallurgical Products Department–will be able to recognize and solve new problems of the Metalworking Industry as they arise.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-59

WA — Semi-Automatic Models. Cutting capacity up to 27" Dia. Ask for catalog #44e.

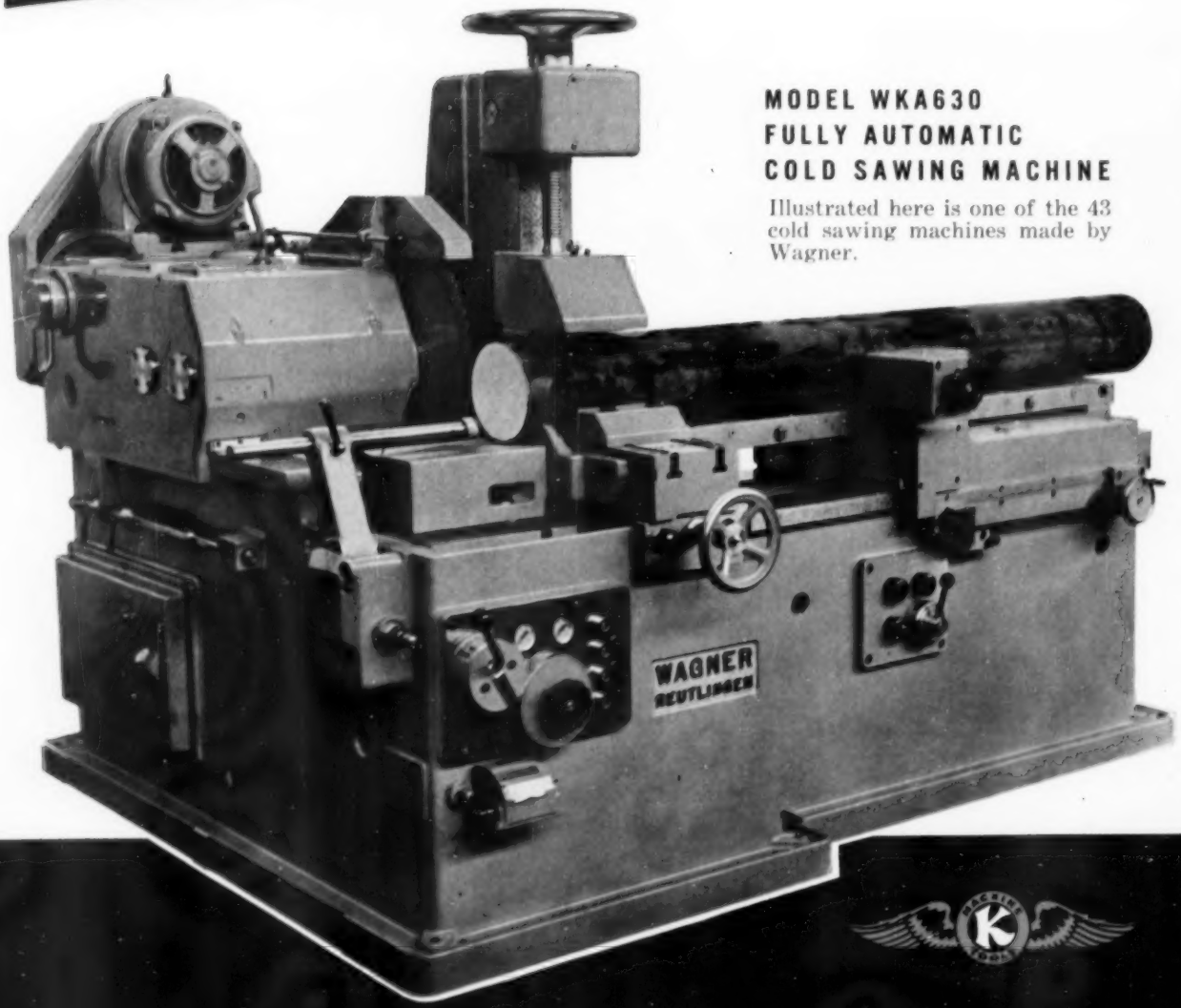


WKU — Universal Foundry Saws. Maximum saw blade diameter 44". Ask for catalog #53e.

WKLM — Long Stroke Models. Maximum cake capacity 12" x 60". Ask for catalog #56e.

WKBB — Semi-Automatic RAIL Sawing and Drilling Machine. Ask for catalog #41e.

WAGNER + Specialization



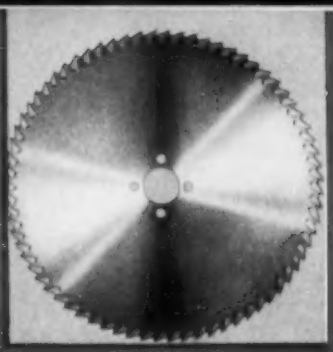
MODEL WKA630
FULLY AUTOMATIC
COLD SAWING MACHINE

Illustrated here is one of the 43 cold sawing machines made by Wagner.

"KLINGELHOFER FOR MACHINE TOOLS"

New TWO POINT DRIVE reduces axial thrust and backlash. Facilitates sawing of SUPERALLOYS.

Automatic Saw Blade Sharpener. 3 Models with capacities 52" and 72". Ask for catalog #51a.



Original Wagner Segmental Saw Blades up to 71" Dia. Ask for catalog #50a.

Example of Wagner efficiency. Cuts 10" steel continuously at the rate of 25 per hour.

+ Automation = TOP OUTPUT

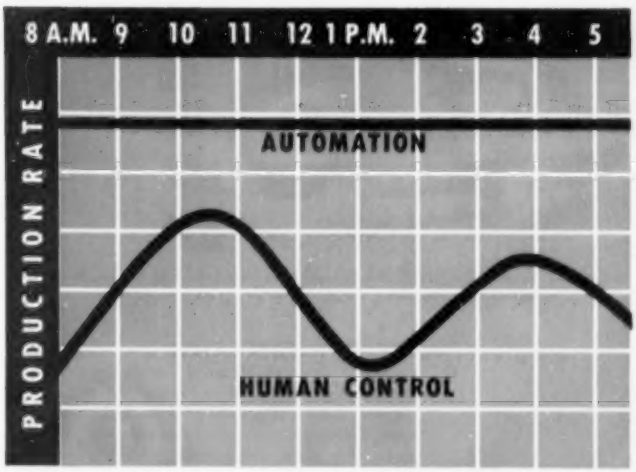
Wagner, the original name in hydraulic cold sawing machines, now offers automation plus specialization in the field of metal cutting. Circular sawing is a fast, economical method for cutting metals. Now it is taking its rightful place in automation with such well-established processes as milling, drilling, tapping, reaming, and boring.

A Wagner cold saw is the reliable starting point to such automation. Its efficiency will maintain your production peaks and its versatility permits the use of less expensive standard stock.

Let us know your problems. We will suggest the right machine to do your cutting job most efficiently. Write for details.

43 MODELS OF COLD SAWS to meet your requirements

Wagner, with a complete line of automatic, semi-automatic and specialized machines, covers the entire field of cold sawing of conventional alloy steels, including the stainless types. These models, with extended speed ranges, will efficiently cut a wide variety of the NEW SUPERALLOYS.



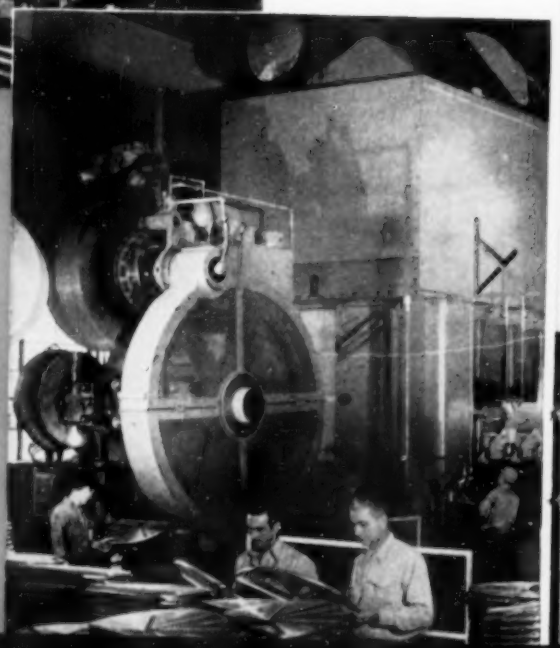
AUTOMATION OVER HUMAN CONTROL

As the above chart shows, AUTOMATION maintains Peak Production throughout the day — fatigue or slow starts do not influence your production schedule.

Albert
KLINGELHOFER MACHINE TOOL CORP.
Kenilworth, New Jersey

THIS ONE MAKES PANS . . . Pans are produced at the rate of ten a minute in this 700-ton seven-station Bliss transfer feed press. A 22" x 24" blank is drawn 5 3/32" deep in the first station; trimming, piercing and restriking operations follow. Pans leave the press completely finished — ready for pickling and enameling.

THESE TWO MAKE SHELVES . . . "Lazy Suzan" shelves by the millions are the product of these two 800-ton Bliss transfer feed presses and the two Bliss embossing presses stationed at their output ends. Coil stock is blanked in the first stations of the presses and work pieces carry through the remaining five stations and into the embossing press automatically. Each press produces 15 shelves per minute through two shifts.



Kenilworth, New Jersey

BLISS TRANSFER FEED PRESSES STEP UP GE REFRIGERATOR PRODUCTION

Here's what's happening at Appliance Park: 6000-pound coils of steel feed into one end of these Bliss transfer feed presses, lines of shelves and pans march out the other ends, and only a few attendants stand by in between.

Three separate press lines are involved. One is a 700-ton, seven-station press (with coil cradle, straightener and roll feed) that produces ten deep-drawn pans a minute.

The other two – identical set-ups – are 800-ton, six-station presses, also with cradle, straightener and feed, which feed into 800-ton embossing presses (see photo). Each produces shelves at the rate of 15 per minute.

The method of operation is the same for all. Mill coils are loaded on the cradle. From there, strip feeds through the straightener and into the roll feed. At the first die station in the press a blank is cut off. The transfer feed fingers move in on the work piece and carry it to the next station. As the slide comes down, the fingers move out; as it rises, they move in and repeat the cycle. New strip is brought to the first station and a completed part delivered with every stroke of the press.

This set-up has solved a number of knotty problems for General Electric. Previously production required the services of two or three vendors, doubling and tripling the cost of dies and labor. Still further savings have come from the use of standard mill coils instead of blanks. In fact, the savings are expected to bring about an early amortization of the entire installation.

Bliss has been building transfer feed presses and systems like this since Spanish-American War days; today, over a thousand are in use. If you're faced with long-run production problems, let a Bliss engineer show you some typical uses of the transfer feed principle. Perhaps it can pull your production costs into line – as it has for so many others.

SEE IT IN ACTION . . . *A new color-and-sound movie takes viewers to the plant, shows the press in action. See close-ups of tooling, of transfer fingers, of coil feed techniques. To arrange a showing at your plant, write to E. W. Bliss Company, Canton, Ohio, or see your local Bliss representative.*

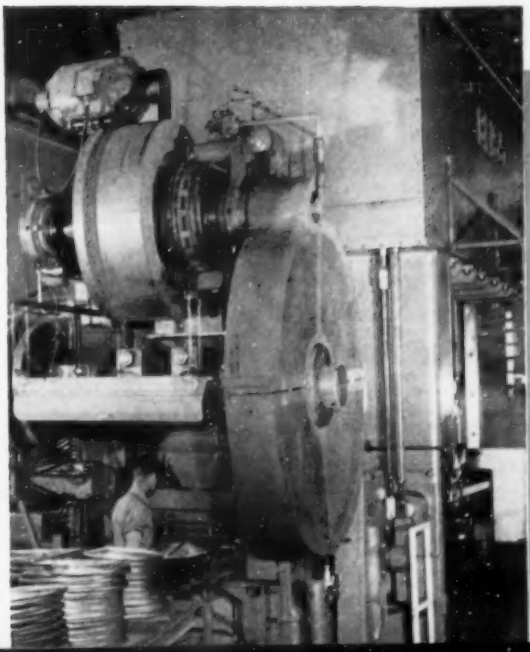
BLISS
SINCE 1857

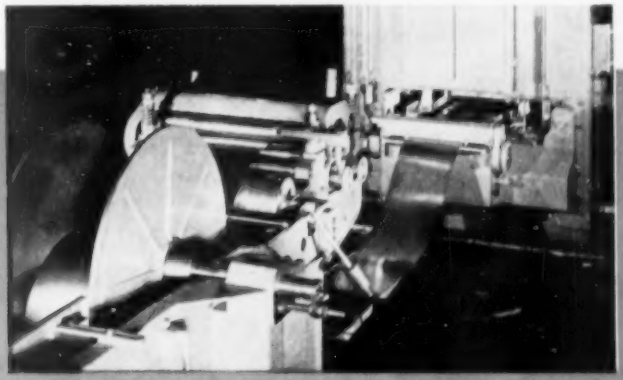
E. W. BLISS Company, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

is more than a name . . . it's a guarantee

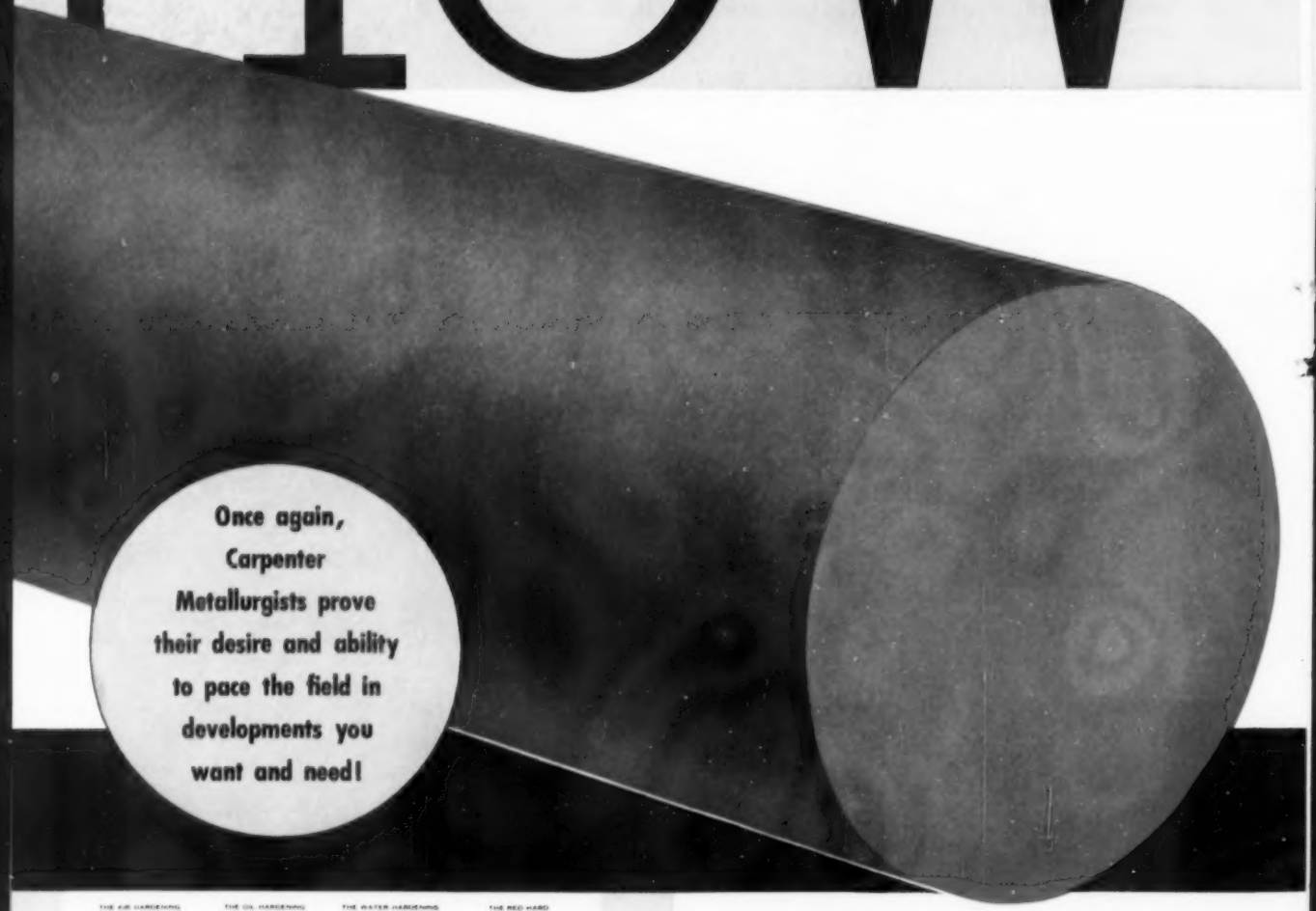
U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Calif. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*





ALL THREE LINES WORK FROM COIL STOCK . . . A number of handling operations are eliminated because, on each of the three presses, strip from standard-sized mill coils are fed from this power coil cradle through a five-roll straightener and into the roll feed on the press. Blank is cut off in the first die station of the press. Though not shown here, a second coil is ordinarily held ready at the rear of the cradle to speed handling. Bliss engineers designed all the coil handling equipment and all of the tooling for each of the presses.

now



Once again, Carpenter Metallurgists prove their desire and ability to pace the field in developments you want and need!

Like all Carpenter Matched Tool and Die Steels every bar of STENTOR (Oil-Hard) is colored full length in its own distinctive color for quick, positive identification! Immediate availability from your local Carpenter Mill-Branch Warehouse, Office or Distributor.

® *U.S. Patent Office*

...*Carpenter* extends the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility . . .
safe, dependable hardening through a broad range of 1425°F to 1525°F

The many advantages which make STENTOR one of industry's most used and talked-about steels are affected in no way by this exclusive new development. Its simplified analysis remains unchanged. It is still the easiest and one of the safest oil-hardening steels to harden. Requires no preheating whatsoever. Hardens from a lower temperature. Assures you less size change and distortion . . . uniform hardenability . . . full freedom from decarburization . . . long, dependable service.

And NOW . . . an extended Built-In Safety Factor enables you to heat treat STENTOR tools, dies and parts either of two ways: (1) At temperatures as low as 1425°F for the cost savings this brings you . . . or (2) Place them right in the furnace with other tools that are heat treated at temperatures up to 1525°F, and eliminate special furnace runs.

If you are not already using Carpenter STENTOR, it's time to *re-evaluate* the *extra* advantages you get with this versatile die steel.

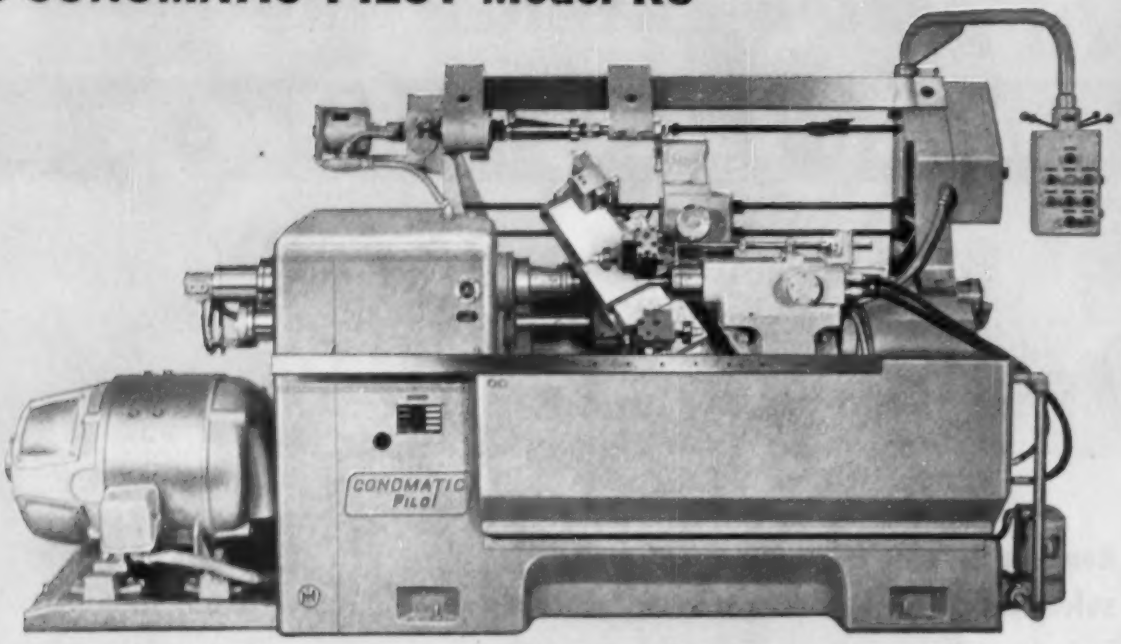
JUST PRINTED! For more facts on how you and your men can Step Ahead with STENTOR, drop us a line on your Company letterhead for this new descriptive folder.

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa.
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

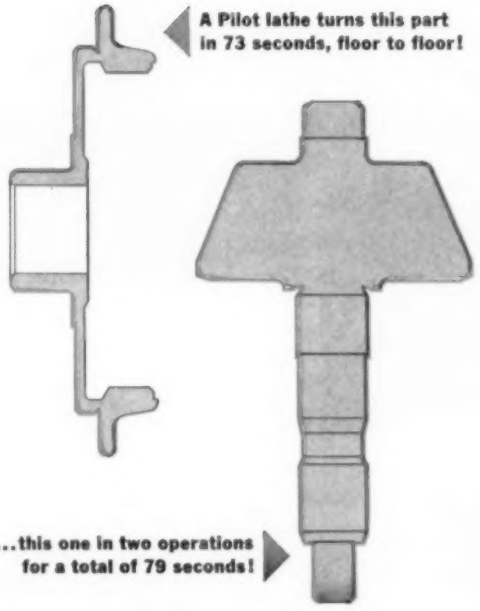
The CONOMATIC-PILOT Model KU



Cone Automatic is now manufacturing the world's most versatile copying lathe...

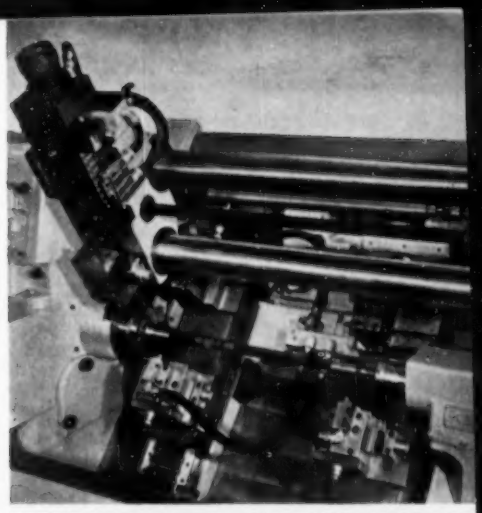
Cone Automatic Machine Company has acquired all rights to the manufacture and sale in the United States and Canada of the famous Pilot lathe. This hydraulically-controlled multicycling copying lathe has already proved its unique adaptability to automated production layouts in the plants of leading U. S. automobile producers and other manufacturers whose products require parts profile-turned to precise tolerances.

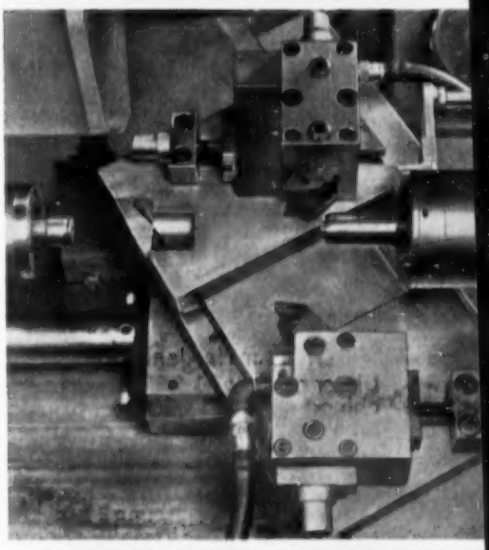
For more details, mail the coupon at the bottom of the right hand page today. We will send you a copy of the new Conomatic-Pilot Lathe Catalog. It's yours for the asking.

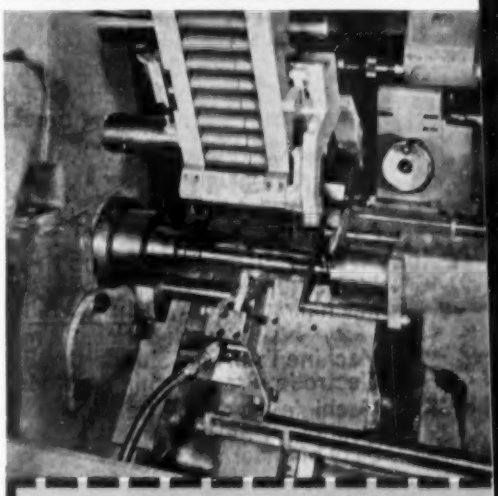


The Conomatic-Pilot KU offers:

- The advantage of a single-point copying lathe plus adaptability to virtually any number of tool stations. Top photo shows typical set-up.
- Smooth, even finish on all surfaces of the work piece: piloted hydraulic feed provides constant feed per revolution.
- Advantage of dual motion tool blocks when using 60° slide (see middle photo).
- Plenty of space near work area to mount automatic feeds and unloading systems. A typical automated arrangement is shown in the bottom photo.
- All cutting tools tangentially mounted for vibration-free operation.
- 45° inclined bed to ease chip removal—wear-proof nitrided steel slide ways.
- Rear tool blocks that can plunge-cut 90° shoulders or copy turn in reverse.
- Front and rear tool blocks that can copy different profiles from same motorized rotating template.







Conomatic

CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

PILOT DIVISION

Cone Automatic Machine Co., Inc.
30 Rockefeller Plaza New York 20, N. Y.

Please send me a copy of your new catalog on the CONOMATIC-PILOT hydraulic copying lathe.

NAME_____ TITLE_____

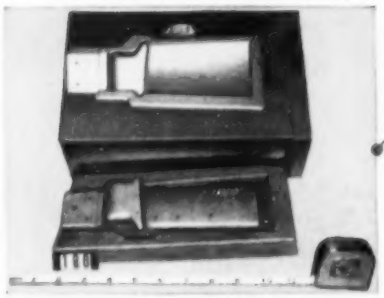
ADDRESS_____

COMPANY_____

CITY_____ STATE_____

FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.

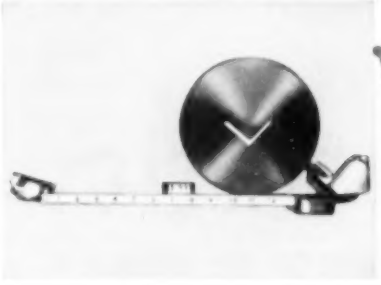
EMBOSSING DIE

Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass

EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF

EDM

. . . 4 jobs that prove

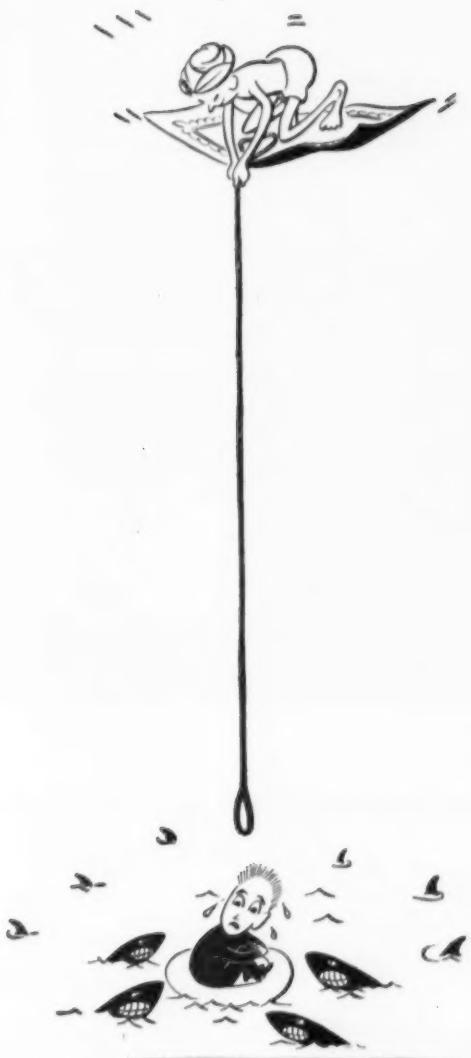
Elox puts you ahead of competition

These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox corporation of michigan ®T. M. Reg.

1837 N. Stephenson Highway
Royal Oak 3, Michigan

CITY _____ STATE _____



...for delivery when you need it

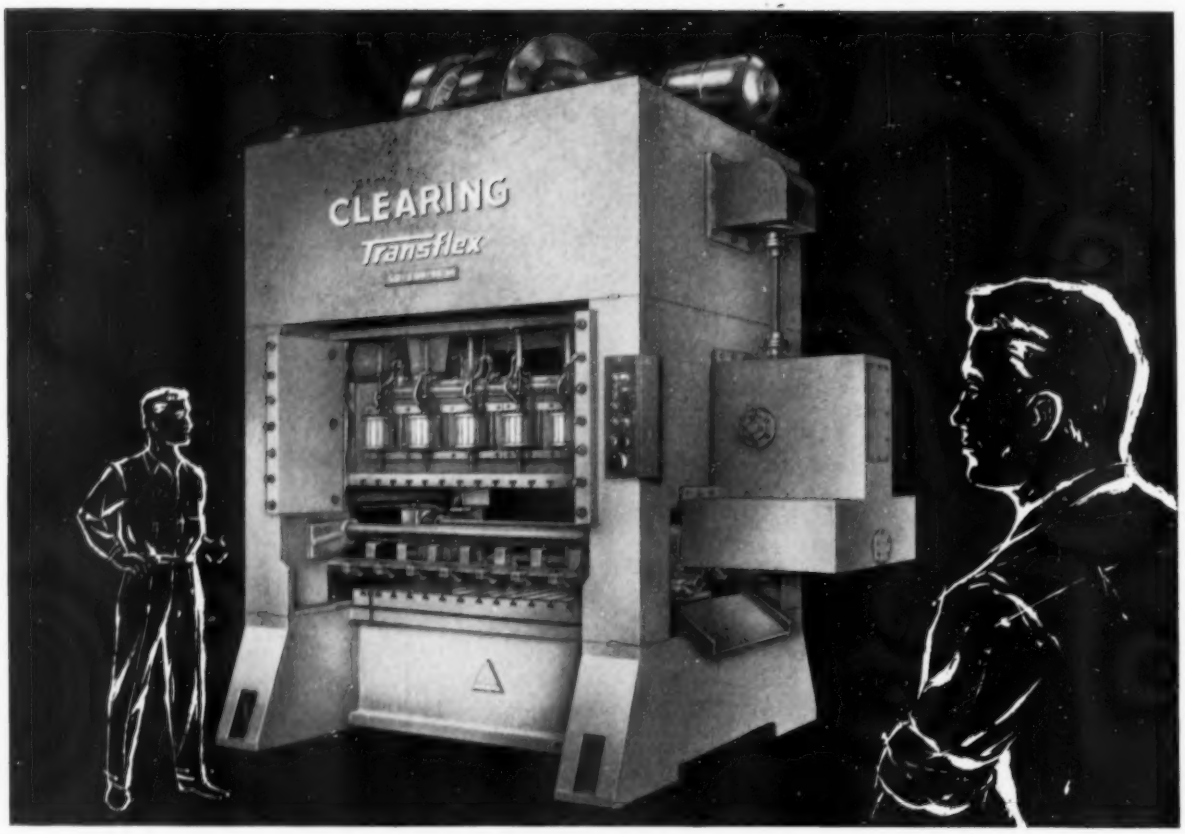
SEE YOUR

Threadwell

DISTRIBUTOR

FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.



Press automation for small parts at moderate cost?

Yes, with a Clearing Series-S Transflex Unit

Operating station center-distances are variable.

Feed fingers readily adjust for different sizes of parts.

Die cushions are adjustable right to left.

Knockout positions adjust right to left.

Transflex—transfer feeding plus the ability to produce a variety of parts—has now been applied to Clearing Series-S presses. These moderate priced straight side presses are produced in capacities from 75 through 300 tons.

These presses have all the major adjustment features typical of all Transflex units. In addition, provision is made for fast detachment of the finger bars so that die changes are quick and easy. Feed change-over—as required from part to part—is practically instantaneous.

As a result, it is now possible for manufacturers with requirements for a number of different medium size parts to automate production even when runs are not long. These presses bridge the gap between progressive die production and the conventionally large transfer presses. It is possible to have as many as sixteen die stations on a single press of this type.

A press like the one above can provide your plant with press automation *plus flexibility* of production at a cost that heretofore would have been considered impossible. We have a great deal of information on Transflex available. It's yours for the asking.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *division of* **U. S. INDUSTRIES, INC.**

6499 W. 65th STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT • HAMILTON, OHIO

Officers

Howard C. McMillen
President
Bedford, Ind.

Harold E. Collins
Vice-President
Houston, Texas

George A. Goodwin
Vice-President
Dayton, Ohio

Wayne Ewing
Vice-President
Los Angeles, Calif.

H. Dale Long
Vice-President
Chicago, Ill.

John X. Ryneska
Treasurer
Lynn, Mass.

William Moreland
Secretary
Ashland, Ohio

Harry E. Conrad
Executive Secretary
Detroit, Mich.

Allan Ray Putnam
Asst. Executive Secretary
Detroit, Mich.

Board of Directors

H. C. McMillen
Bedford, Ind.
G. Ben Berlien
Oakland, Calif.
I. H. Buck
Dallas, Tex.
H. E. Collins
Houston, Texas
Wayne Ewing
Los Angeles, Calif.
G. A. Goodwin
Dayton, Ohio
H. Dale Long
Chicago, Ill.
P. R. Marsilius
Bridgeport, Conn.
Wm. Moreland
Ashland, Ohio
H. B. Osborn, Jr.
Cleveland, Ohio
J. L. Petz
Poughkeepsie, N. Y.
J. X. Ryneska
Lynn, Mass.
L. C. Seager
Salt Lake City, Utah
C. M. Smillie
Detroit, Mich.
W. A. Thomas
Windsor, Ontario

Editorial Committee

G. Ben Berlien,
Chairman
Oakland, Calif.
Donald E. Zierk,
Vice-Chairman
Baltimore, Md.
Harold W. Hagle
Wesleyville, Pa.
Joseph L. Petz
Poughkeepsie, N. Y.
Harold Sullivan
Minneapolis, Minn.
Leo Tarasov
Worcester, Mass.
Donald E. Wernz
Dundee, Ill.

The **Tool Engineer**

Silver Anniversary

We seldom take the time to reflect on the past or to anticipate the future but anniversaries compel us to acknowledge the passing of significant mileposts. During ASTE's short existence, unparalleled advances have been made in our standard of living. Our anniversary theme, "A Better Life Through Creative Manufacturing," truly typifies our activities during the past quarter century. ASTE's contribution to the future will be even more effective.

Members of ASTE have made the past accomplishments possible. We must never forget that people are the all-important ingredient of our Society. Therefore, we salute those many, dedicated thousands who have helped lift the load at all levels of the Society.

Growth of ASTE has been outstanding. This very growth, however, and the potential for the future, pose problems that probably were not anticipated when the Society was incorporated. Our members have, and will have, many increasing responsibilities. ASTE has been described as a "Society of the Membership" and this is priceless. This quality prevents us from degenerating into an impersonal, "stuffy" organization. How to maintain this characteristic in the face of growing membership and an increasing number of chapters is one of the more important problems we have. How to raise our professional standards and maintain member interest, and how to be of more service to industry are other pressing problems.

Thoughtful selection and support of Society leaders is important in order to keep objectives and activities in proper balance. Continued interest of the membership will assure this.

We are justly proud of ASTE's accomplishments and confidently expect even greater ones in the next 25 years. We salute those who will continue to build ASTE and contribute so richly to our way of life!

H. C. McMillen

PRESIDENT

BUYERS GUIDE TO STAINLESS

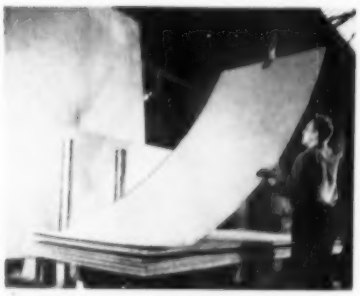
A Directory of Ryerson Stainless Steels and Services

Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of Allegheny stainless in stock at Ryerson.

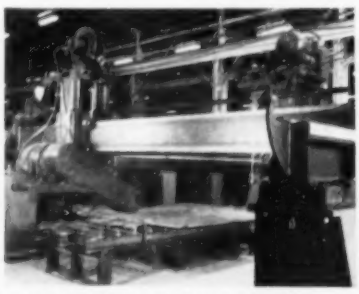
This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping—such as padded shear clamps to protect finish and flatness of sheets—guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of Allegheny stainless—one piece or a truckload.

SHEETS—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs.



PLATES—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



TRUE-SQUARE DISC CUTTING—Stainless plates up to 12' x 25' cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32".

A NEW STEEL—Type 202 Allegheny Stainless is available in 14 to 26 gauge sheets. Type 202 compares favorably with 302 in corrosion resistance; costs 2¼¢ per lb. less.

BARS AND ANGLES—Rounds, squares, flats, hex's and angles in 8 types including free-machining bars with bath analysis and mechanical properties controlled for best performance.

CIRCLES, RINGS, SPECIAL SHAPES—Practically any shape, no matter how intricate, can be accurately flame cut from stainless steel plate by skilled Ryerson operators.

PIPE AND TUBING—Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also flanged, screwed, welding and Quikuple fittings and Cooper stainless valves.

AIRCRAFT STAINLESS—Sheets, strip, plate and bars to Government and Aeronautical Specs. Write for Ryerson Aircraft Steels booklet.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK · BOSTON · WALLINGFORD, CONN. PHILADELPHIA · CLEVELAND · CHARLOTTE · CINCINNATI · DETROIT · PITTSBURGH · BUFFALO CHICAGO · MILWAUKEE · ST. LOUIS · LOS ANGELES · SAN FRANCISCO · SPOKANE · SEATTLE

Trends in tool engineering

Advances in tool engineering are evolutionary, rather than revolutionary, in nature. By looking at some of today's important trends, it is possible to predict some of the areas in which further progress will be made.

By T. W. Black
Associate Editor

DURING THE PAST 25 years, the over-all productivity of manufacturing operations has increased manyfold. Production has become faster—more automatic—more accurate. Spurred by the harsh necessities of war and the competitive pressures of peace, tool engineering, once a cut-and-try proposition, has come closer to being a science. Basic developments in electronics, chemistry and a host of other physical sciences have shown the way to new concepts of production and new manufacturing processes and techniques. This has called for creative tool engineering of a high order.

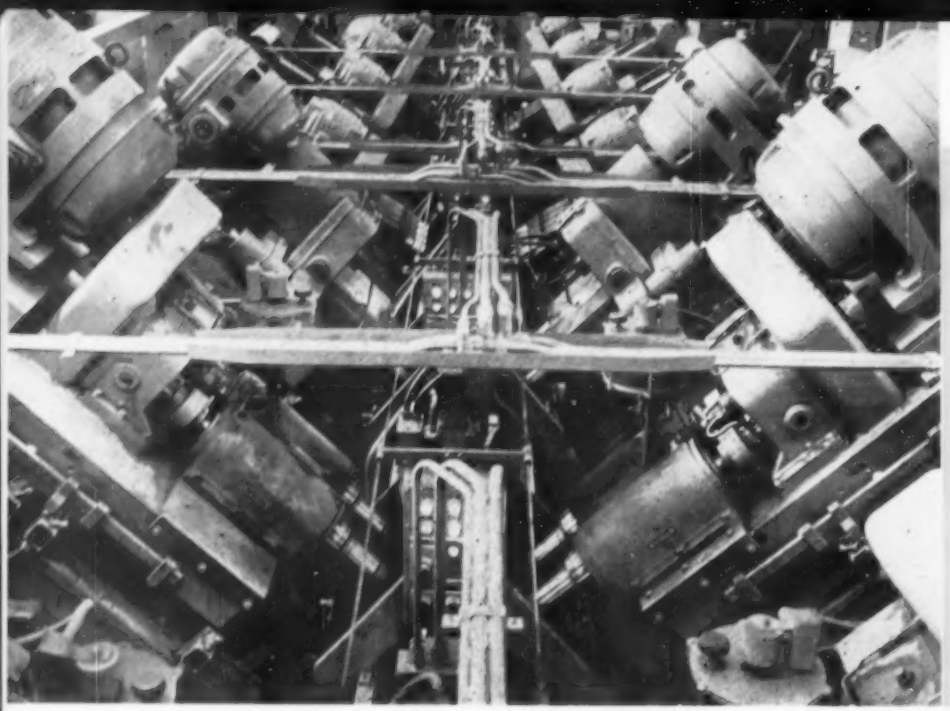


Fig. 1. Section of Plymouth engine block line. Two bores in each bank are semifinished simultaneously. Large spindles promote accuracy.

Special Machines: The primary goal of tool engineers is production of quality products, in the required quantities, at the lowest possible costs. Where production volumes are high, special machines, designed to perform one specific operation or series of operations, are an effective means of reducing costs. Utilization of such machines is an increasingly important trend in mass production metalworking.

Perhaps the most spectacular applications of special machines have been in the automotive industry, typified by the development of transfer machines for cylinder heads and blocks. Such machines are not a new development. The first transfer machine was built in 1932 by the National Automatic Tool Co. Cylinder blocks were carried through the machine on a fixture. Six heads performed a series of operations, including rough and semifinish boring camshaft and crankshaft bores, drilling the outer wall of the camshaft holes and counterboring the welsh plug holes. Production was 90 blocks per hour.

Today, many transfer machines in use are capable of performing dozens or even hundreds of successive operations on engine blocks and similar parts. The Ex-Cell-O machine illustrated, *Fig.* 1, is part of the Plymouth engine block machining line. Total length

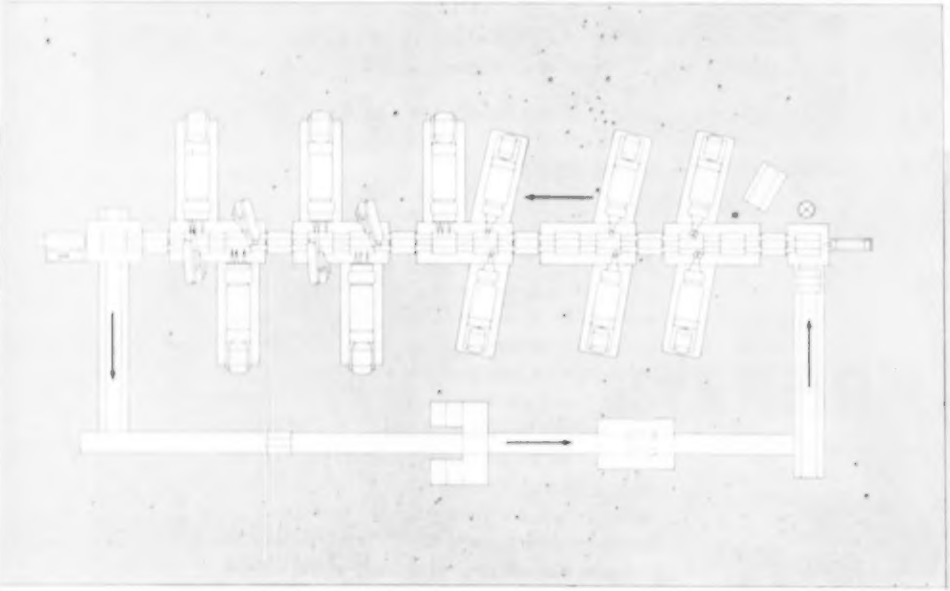


Fig. 2. Unitized transfer machine. Machine consists of five identical machine bases plus separate and interchangeable machining heads.

of the line, which is made up of individual transfer machines connected by shuttles and turnover devices is 1380 feet. The entire line can be regarded as one large integrated machine.

Precision limit switches stop the machine if parts are not correctly positioned in each station, and inspection and gaging stations are integral parts of the machine.

Transfer machines have a number of important advantages. Since parts are loaded and unloaded automatically, it is possible to utilize machine time to the fullest extent. There are no delays for manual loading of parts. Further, the floor space required for an automated machining line is considerably less than would be required for a line of individual machines to perform the same series of operations. The effective utilization of machine time reduces the number of machines required. Safety conditions are improved and operator fatigue is lessened.

Unitized Machines: Conventional transfer machines are tremendously productive. However, the high production rates have been attained at the expense of machine versatility. The machines are intended to manufacture one product and cannot be readily adapted to accommodate different or revised products. In the event of a product change, extensive reworking is required. In extreme cases, the machine may be obsoleted even though it is in good condition.

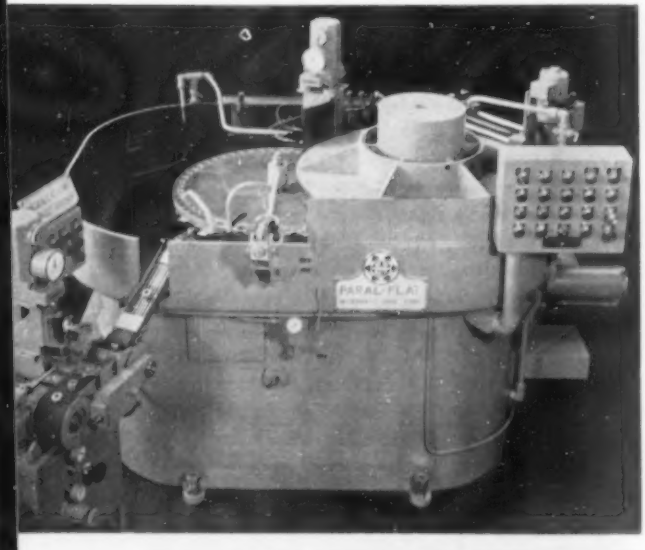


Fig. 3. Machine for generating parallel faces on small gear blanks. Air gage provides feedback control.

One partial answer to this problem is to design transfer machines with the possibility of product change in mind. It is a common practice, for instance, to leave some machine stations idle so that additional operations can be incorporated as required.

A further step is the design of so-called "unitized" transfer machines, made up of standard, interchangeable machine bases and standard interchangeable heads. One such machine, *Fig.* 2, is used in the Windsor plant of Ford Motor Co. of Canada for the manufacture of upper and lower ball joints. The operations performed are boring, facing, chamfering, rough and finish forming, drilling, spotfacing, reaming and tapping.

Unitized construction adds greatly to the potential utility of a machine. Since each side of the machine bases is completely machined, work stations may be located at any position on those faces. If a product design change is made, additional machining heads can be added and complete machine base sections can be added or removed as required.

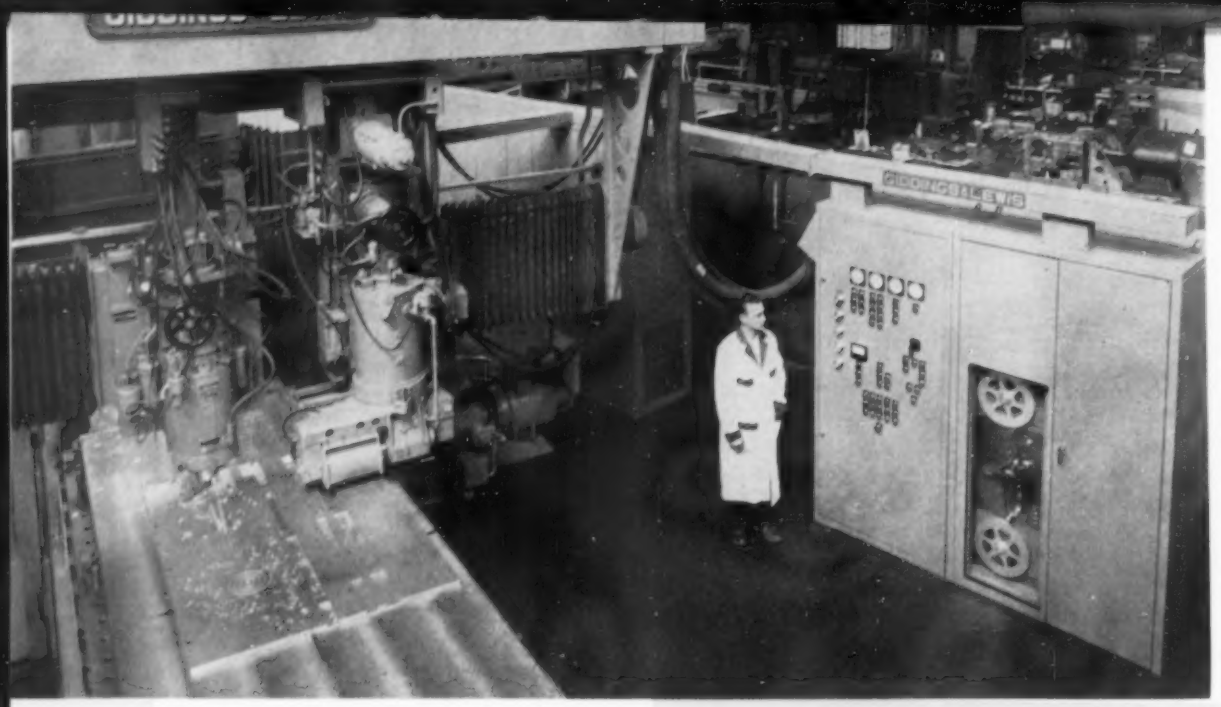
The heads are standard hydraulically operated self-contained units. Each unit is individually powered and has a wide range of speeds; feed is infinitely variable.

Use of standard machine base sections and machining heads greatly extends the versatility of transfer machines without limiting their productivity. It can be anticipated that when unitized machines come into general use they will enable high-volume manufacturers to significantly reduce their obsolescence costs. At the same time, they should extend the application of automation by medium-run producers who cannot afford specialized single-purpose transfer machines, but who might find it profitable to invest in standard machine bases and heads which can be grouped together and interchanged at will, making them adaptable for a variety of products.

Similar principles have been applied to the design of center-column indexing machines. Many builders specialize in furnishing standard indexing tables to which separate drilling, reaming, tapping and milling heads can be added to perform a desired series of operations. Change-overs from one product to another can be accomplished by adding or removing machine heads and installing appropriate cutting tools.

Finding means of combining the benefits of automatic operation with the advantages of machine flexibility will undoubtedly be an increasingly important trend in processing in the future.

Feedback: Automatic loading and unloading of parts leads to full utilization of machine time, making it possible to run a machine continuously, stopping only for tool changes and machine adjustments.



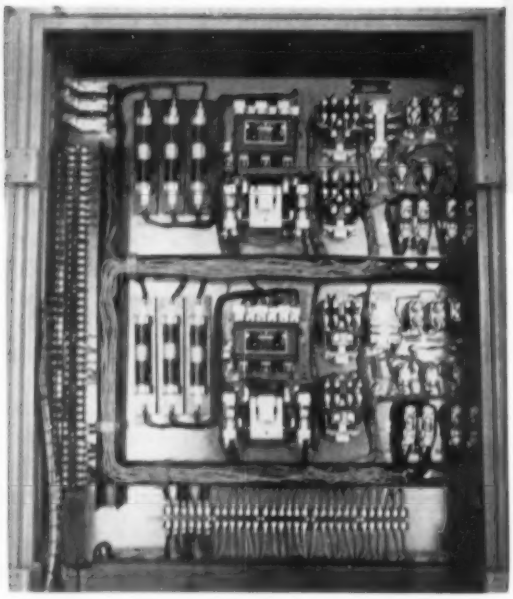


Fig. 4. (above) Spar and skin milling machine operates under complete control of a magnetic program tape.

Fig. 5. (left) Interior of a control panel for the General Electric electronic tracer control system. Components and wiring are readily accessible for maintenance.

Often, parts are checked by automatic gages which stop the machine in the event parts are not within required tolerances. This is feedback in its simplest form; output information is used to control the input of parts. Machine adjustment is left to the operator. To be fully automatic, however, a machine must have the ability not only to detect errors, but to correct them.

Several types of self-correcting machines are in general use. An interesting example is the Paral-Flat machine developed by Micromatic Hone Corp. This machine, *Fig.* 3, is designed to generate parallel and flat end faces on pinion gears.

As gear blanks are fed into the machine they drop onto a plate that carries them between two abrasive disks. The motion of the carrier plate and the path the parts follow as they travel between the rotating disks distribute the abrading action uniformly on the surfaces of the workpieces. When the finished parts are carried out from between the abrasive disks, they pass under an air gage which checks their height. A feedback signal from this gage controls the thickness of the gear blanks by adjusting, when necessary, the distance between the disks. During setup, or after any interruption in the operation, this control automatically positions the abrasive disks, eliminating any need for manual adjustment.

As soon as parts of the proper height pass the gage, indicating that the proper disk spacing is established, a gate opens and the blanks drop onto a second conveyor where they are checked for parallelism by another automatic air gage. No feedback control is exercised by this gage, other than to stop the machine when a predetermined number of parts are not within the required tolerance.

The application of feedback principles is not restricted to especially designed machines. Several manufacturers have developed "building block" controls which can be used with conventional machine tools to give automatic machine control. These units

gage work pieces either during or immediately after machining, and then automatically make any necessary adjustments. Fully automatic operation is achieved without the substantial investment required if special machines were purchased, thus making it possible for short-run producers to obtain the benefits of automatic production without extensive outlays for special machines. General recognition of the value of feedback controls should lead to their increasing utilization in the future.

Programmed Machine Tools: Special machines, designed to perform only one operation or series of operations on a part, do not require any great degree of control on the part of an operator; the program is built into the machine. At the opposite end of the spectrum are standard types of machines, which are extremely versatile but require full control by the operator. Such operation is necessarily slow, because the operator must translate blueprint dimensions into terms of machine movements, and there is always the possibility of human error.

In recent years, many types of programmed machine tools have been developed with the objective of expediting machining operations by eliminating the need for operator control of machine movements.

The simplest type of control operates from "instructions" on a cam or master template. This principle is used in the Onsrud automatic contour milling machine designed for the U. S. Air Force. The 84-foot-long machine is used for milling spar beams and similar parts with lengths up to 60 feet. A gantry type carriage houses four cutter motors with a total of 12 different feed motions, all under electronic tracer control, plus longitudinal feed. The four heads can be operated together, singly, or in any combination.

The machine represents a departure from conventional tracer machines in that there is no mechanical linkage between the template follower and the controlled motion of the head. The electronic control thus simplifies machine construction and allows templates to be mounted in almost any position alongside the machine.

While tracer machines do not represent a new development, the tracer principle takes on increasing importance as the size and complexity of both machine tools and workpieces increase, and as cutting feeds and speeds rise. It has been said that it would be a physical impossibility for an operator to apply efficient manual control to a machine such as the Onsrud, in which many different motions must be changed at a predetermined rate.

A further step in development is elimination of cams and master templates. Programmed milling machines operating from punched cards or paper and magnetic tape have been in successful production operation for some time. A representative control, the Giddings & Lewis Numericord system, *Fig. 4*, operates as follows:

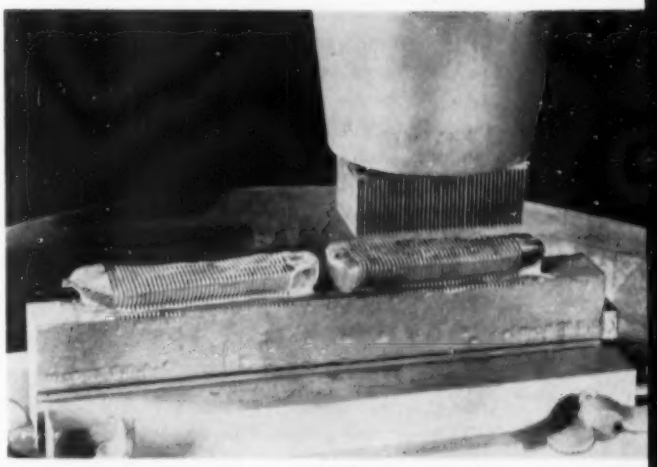


Fig. 6. Tool for ultrasonic machining of sapphire. Resulting wafers are 0.020 inch thick. In a subsequent operation, bearing blanks, 0.070 inch in diameter, are cut from the wafers, also by ultrasonic methods. Machine is a Sheffield Cavitron.

Numerical data, calculated from engineering drawings of the workpiece, tooling studies and machine tool feed rates, are fed into a paper tape preparation unit in decimal form. A computing director converts the decimal data into time-controlled continuous electrical signals. These signals are recorded on channels in a master magnetic tape. The control unit reads the tape to control the movement of the machine table and two heads in feed, traverse, rise and fall.

Only the magnetic tape playback and machine control units are located at the machine site. Paper tape preparation units and the computing director, with its magnetic tape recording unit, are installed in a location remote from the machining area. Thus, magnetic-tape machining programs can be prepared on a production basis for all machines in a shop. Backlogs of tapes can be maintained in readiness to change production of any machine from one part to another with minimum lost time.

The system is capable of simultaneously controlling as many as five machine axes in three dimensions, plus up to 22 auxiliary machine functions. Audio commands to the machine attendant can be included on the magnetic tape to alert him to tool change and machine inspection stops in the planned machining program.

There is a large range of potential applications for programmed machines. As they are developed further, they will be increasingly utilized.

Standardization: With emphasis on automatic production, tool and machine maintenance problems have received increasing attention. Accessibility for

maintenance is now an important consideration in the design of production lines and in selecting machinery and equipment. Similarly, greater attention is being paid to specification of machine components which give longest service. Many standardization programs are being carried out with the objective of promoting trouble-free operation and minimum maintenance. To take only one example, users, machine tool builders and equipment manufacturers have banded together to produce the Joint Industry Conference standards pertaining to electrical, hydraulic and pneumatic equipment, *Fig.* 5.

Despite the many organizations working on standardization, much remains to be accomplished. The ASTE-supported program for standardization of the mounting dimensions of hydraulic cylinders will, for instance, greatly facilitate machinery and equipment maintenance.

New and Improved Processes: Many of the major advances in manufacturing during the past 25 years have come as the result of new processes which could not have been foreseen at the start of the period. The application of ultrasonics to cleaning, soldering, welding and machining of parts, for example, is a direct outgrowth of World War II research on underwater sounding devices. Ultrasonics have made it possible to machine many materials such as germanium, saphire, Fig. 6, silicon, quartz, magnetic ferrite and ceramics, which are extraordinarily difficult to machine by more conventional methods. Tooling costs are low. Spark-discharge machining is another new process which has aided in processing difficult-to-machine materials.

An important trend has been the development and application of processes for producing parts to extremely close tolerances without extensive machining. Cold extrusion methods of forming steel parts minimize material waste, eliminate several machining operations and often result in products which are superior to machined parts from the standpoint of grain structure. Cold rolling, recently adopted for spline rolling in the automotive industry, *Fig.* 7, is a similar development.

The number and types of parts made from powder metals, *Fig.* 8, increases almost daily. With this process, parts can be quickly and economically produced and there is virtualy no material waste. Means of producing high-density parts on a production basis have greatly extended the range of applications. In foundry work, too, there have been notable advances. Improved techniques of precision casting have made it possible to cast parts to extremely close tolerances, with consequent savings in material and metal-cutting costs.

Research Programs: A substantial portion of the progress in manufacturing during the past several decades has been the result of basic scientific research into the properties of materials. It has been the job of the tool engineer, supported by applied research and development laboratories, *Fig.* 9, to

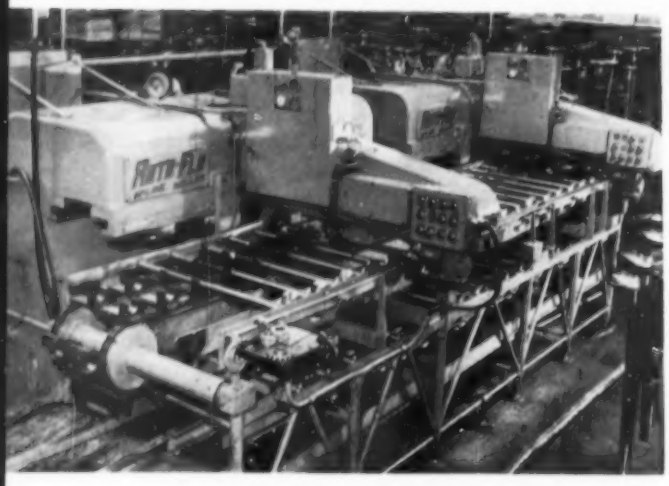


Fig. 7. (above) Cold rolling of rear axle shaft splines at Buick.

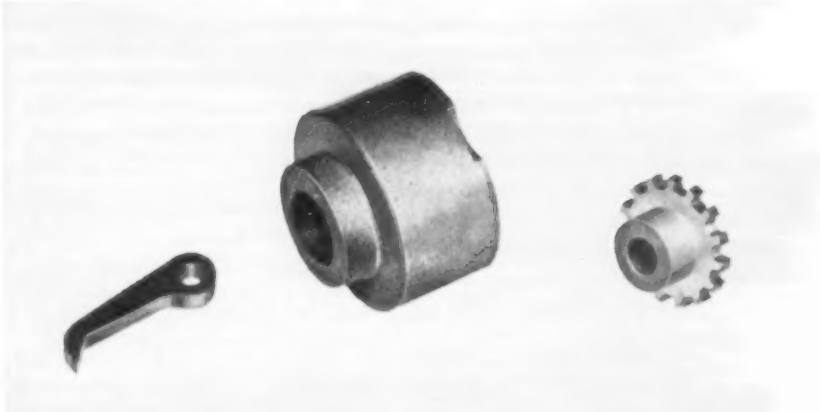


Fig. 8. (right) Feed pawl, roll bearing and ratchet made from sintered metal powders by International Business Machines Corp., Endicott, N. Y. plant. Tolerances are held within 0.001 inch on some dimensions of these parts.

find ways of shaping these new materials into production realities. The development and application of titanium for corrosion-resistant and aircraft applications is a case in point. The properties of this material lead to difficulties in machining and forming. These difficulties have been largely overcome by intensive research and actual production experience.

Carbides have increased metal-cutting rates amazingly since World War II and have been extensively utilized where wear-resistance is at a premium. Their successful application has been the result of cooperative effort on the part of carbide and machine tool manufactureres, working closely with users. Ceramic tools, recently introduced, promise new increases in cutting speeds.

Many new plastics are now available. Tool engineers have learned how to cut and form these materials and have found applications for plastics in production tools. The epoxy resins, for instance, have demonstrated their value for dies, die components and fixtures. These readily-formed materials have strength and dimensional stability which make them capable substitutes for costly steel components. Laminates, too, with their combination of strength, light weight and ease of machining, have found a number of tooling applications.

One of the most significant reasons for success in the search for better materials and methods has been the fact that research and development have been conducted on a planned basis. Increasingly, manufacturing organizations are devoting a portion of their budget to the planned development of methods which lead to higher-quality, lower-cost production. This type of activity has not been restricted to the titans of the automotive and aircraft industry; many smaller companies have found it profitable and even necessary to sponsor manufacturing development programs.

Designing for Production: With increased automation and automatic assembly in the offing, many manufacturers are taking a new look at the design of their products. Often only a small change in configuration, fastening methods or material can reduce manufacturing costs significantly. Here, the specialized knowledge of the tool engineer is invaluable. When automatic operations are contemplated, tool engineers are often consulted during the initial stages of product design. "Project Tinkertoy," in which an electronic assembly was designed for full automatic production, with adequate provision for design changes, is an outstanding example of this kind of approach.

Future Trends: During the next 25 years, there will doubtless be many "breakthroughs" of knowledge leading to new methods and processes which cannot be now foreseen. To a large extent, the future is an outgrowth of the present. To summarize some foreseeable future trends:

1. In process planning, increased emphasis will be placed on the use of highly productive special machines. However, these machines will be more "flexible" than most of those in use at present. They will be of types which can be readily modified for production of new or revised products.

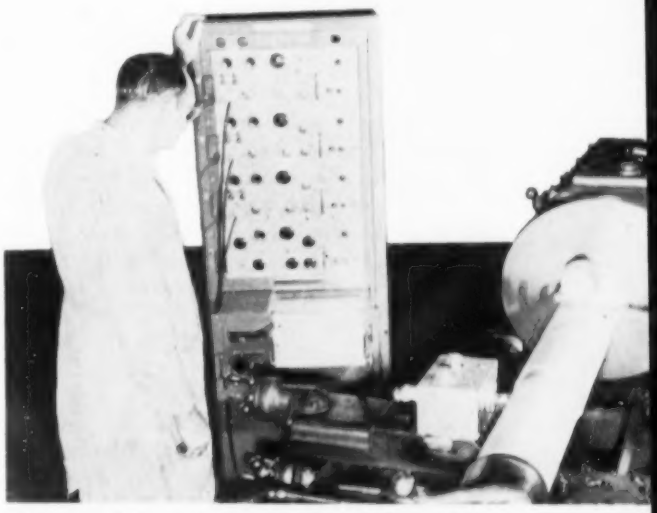


Fig. 9. Carbide cutting tool under test in a lathe at General Electric's Metallurgical Products Department. Various components of force acting on the tool are measured by a four-channel electronic oscillograph.

2. Feedback devices for machine control will be extensively applied, even for comparatively short runs.
3. Programmed machines will be used more extensively.
4. Maintenance will continue to be an important consideration in process planning. Maintenance problems will be reduced through greater standardization of equipment.
5. New developments in materials and processes will be quickly applied to production by means of planned manufacturing development programs.
6. Closer liaison between tool engineers and product designers will result in significant manufacturing economies.

These trends—and others not yet visible—will be accelerated by improved professional training in tool engineering. Some of this training will be at college level; much of it, however, will be in the form of after-hours and on-the-job training programs. Developments in tool engineering are, after all, nothing more than the tangible result of the efforts of individual tool engineers. Adequate training today results in a more productive tomorrow.

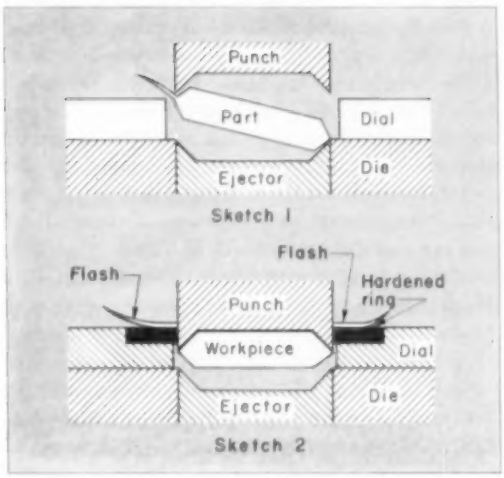
Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Flash Trimming Dial Feed

One of the chief problems encountered in putting dial feeds on dies for trimming flash and sprues from die castings is that frequently the flash holds the part in the nest of the dial feed, preventing the part from dropping into proper position in the trim die, Sketch 1.

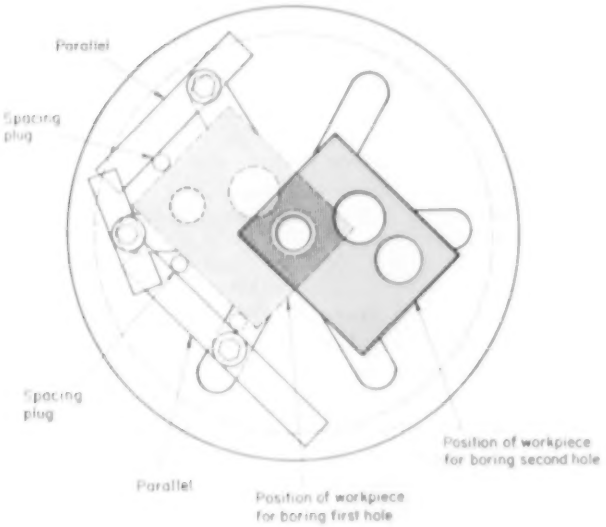
A satisfactory solution to this problem is to surround the nest of the dial feed with a hardened ring, Sketch 2. As the part is carried into the die, the descending punch knocks any excess flash off against the hardened ring in the dial, assuring that the parts fall into the die properly. The flash is blown away by a cam-actuated air blast as the punch rises.



Buckley Sullivan
Cleveland, Ohio

Locating Device for Lathe Boring

Setting and truing of jig buttons on the face plate of a lathe is time-consuming and awkward when locating and boring a number of holes in a workpiece such as a die plate. The locating method illustrated eliminates the use of jig buttons and is particularly adaptable to situations where means for accurate location of buttons on bored work are not readily available.



Two edges of the workpiece should be accurately machined square with each other since it is from these sides that measurements are made to the hole locations. Hole locations must be shown on the layout in such positions that measurements can be made from the squared sides. The location of the first hole to be bored is marked with a prick punch on the workpiece, which is then clamped to the face plate of the lathe.

After boring the first hole, two parallels or straps, each with a perfectly straight edge, are fastened on the face plate exactly parallel to the squared edge of the work. To prevent movement of the workpiece when setting the straps, the straps are set a short distance away from the workpiece by means of a spacing plug.

When relocating the workpiece for boring additional holes, measurements are made from the strap edges, referring to the given distance from the squared sides of the workpiece. The diameter of the spacers used in setting the straps is added to these distances. To avoid the necessity of moving the locating straps after they are first set, the first hole bored should be the one farthest from the squared sides. Care in positioning the straps and in measuring distances when relocating the workpiece will result in accurate work.

Frank E. Chace
Pawtucket, R.I.

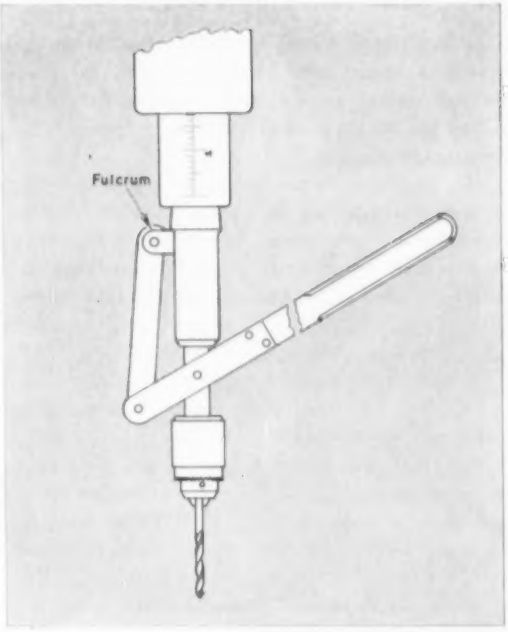
Drill Feed for Lathes

There are many occasions in shop work when it is necessary to use a large lathe for drilling a small hole. The device illustrated, which fits into the tailstock socket of the lathe, provides a means for hand feeding small drills. It eliminates the inconvenience of feeding small drills by means of heavy tailstock screws.

The device consists of a tapered shank body made from an old reamer with the cutting end removed. Two blocks welded to the shank provide a fulcrum. A single link connects the fulcrum point to a forked end handle. The pin which secures the sliding shaft to the handle also prevents the shaft from rotating. A keyway in the body of the tool provides a path for the escape of air.

This tool is easy to build and convenient to operate. Some operators also use it when center drilling. The workpiece is held in the lathe chuck or supported in the steady rest.

Ernest Jones
Bronx, N. Y.



Announcing

Gadgets Contest Awards

Following is a list of the winners in THE TOOL ENGINEER Gadgets Contest. The National Editorial Committee and the editors wish to thank the several hundred ASTE members who participated in the contest. Many of the entries will appear in forthcoming issues of THE TOOL ENGINEER.

• FIRST PRIZE ($100.00)

Allen M. Johnson	Springfield (Mass.)

• SECOND PRIZES ($50.00)

Robert Daly	San Fernando Valley
Norman F. Snyder	Saginaw Valley

• THIRD PRIZES ($25.00)

Michael Surma	Northern New Jersey
Karl W. Nittel	Southeastern Massachusetts
H. B. Wilder	Montreal
Archie Corkigian	Hamilton

• HONORABLE MENTION (Tool Engineers Handbook)

Carl F. Stark	San Diego
Chester Paff	Monmouth
J. W. Kamerer	Chautauqua-Warren
H. D. Hiatt	Indianapolis
John E. Martyak	Binghamton
John F. Rachwal	Buffalo-Niagara Frontier
Ralph Stallman	Golden Gate
William E. Sjostedt	Member-at-large
William Johnson	Cleveland
Stefan Gogol	Ashtabula County

Automatic Indexing Fixture

Milling twelve equally spaced slots in the periphery of a small brass collar has been expedited through use of an automatic indexing fixture designed for use on a small machine equipped with a hand-operated table.

The workpiece is secured to the upper end of a central rotating post by means of a socket-head screw and a thick washer. A dished washer prevents coolant and swarf from penetrating between the pillar and the fixture body. Upper and lower plates of the fixture are welded together and the lower plate is bolted to the machine table.

An index plate is keyed to the central pillar. Dovetail slots in the index plate engage with a sliding index pin which locks it in position.

The plan view illustrates the position of components at completion of the traverse during which milling is accomplished. As the table is traversed back to the left, a nut on a stop rod comes in contact with a fixed stop on the front face of the milling machine column. A second rod, free to slide in the fixture body, is linked to the stop rod and carries a spring-loaded pawl.

When the machine table is moved to the left, the stop rod comes in contact with the fixed stop and the sliding rod is pushed to the right relative to the fixture body. This disengages the index pin from the index plate. The pawl then engages one of the slots in the periphery of the index plate, rotating it 30 degrees. Travel of the table to the left is controlled by a dead stop.

Reversing the direction of traverse of the machine table causes the sliding rod to move left relative to the fixture. The index pin engages the index plate and all components return to the position shown in the plan view. Since the indexing is accomplished during the traverse there is no need to stop the table for indexing.

C. T. Bower
London, England

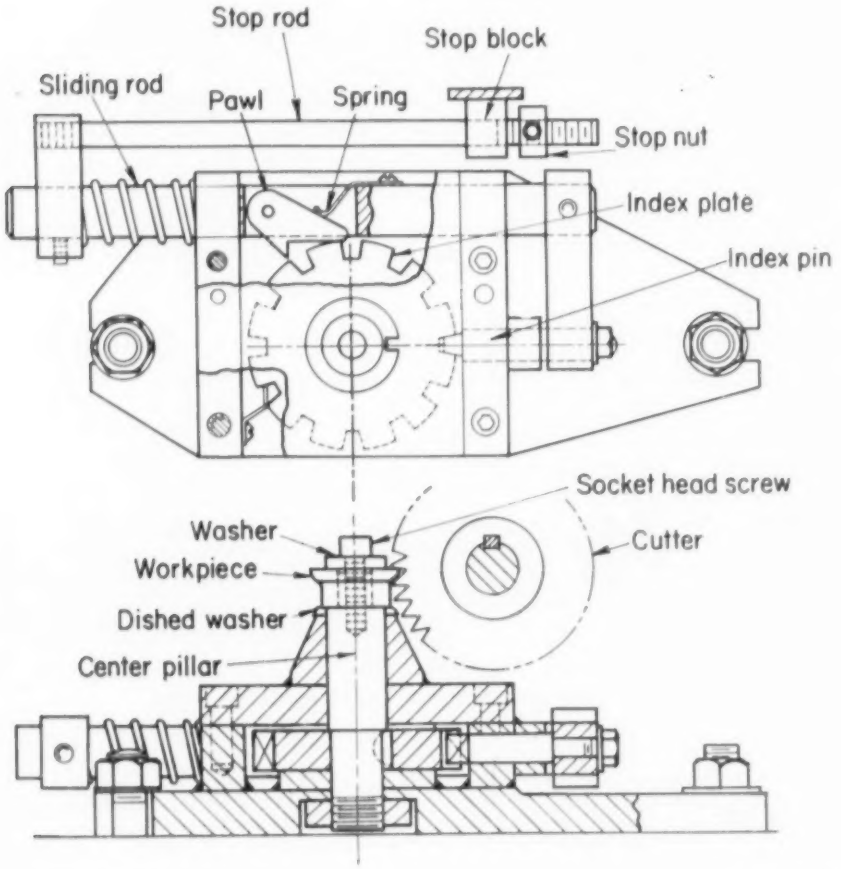


Fig. 1. Satellite, shown here during assembly, consists of two hemispheres and an internal framework which supports electronic instruments.

tooling for the Satellite

By T. W. Black
Associate Editor

Fabricating the earth satellite called for production know-how in working with light metals plus creative tool engineering. Brooks and Perkins engineers, working to a close time schedule, used multipurpose tooling to facilitate production. Other aspects of the satellite program will be covered in the technical session "Engineering Behind an Earth Satellite Launching" at the ASTE Silver Anniversary Convention, Houston, Texas, March 23-28.

SPACE TRAVEL, considered to be an impossibility only a few years ago, has been brought closer to reality with the completion of several earth satellite missiles. These missiles will be propelled to an altitude of 300 miles by a three-stage rocket and will circle the earth for several weeks to a year at speeds as high as 18,000 miles per hour. Information gathered during flight, radioed back to earth, will increase man's knowledge of the earth and provide data on conditions in space.

The skin of the satellite is made up of two hemi-

spheres assembled together to form a 20-inch diameter ball. This ball contains a framework designed to make the shell more rigid and to support some ten pounds of instruments and four projecting antennae. All components of the internal framework and the skin itself are fabricated from magnesium, with a total weight of only four pounds.

From a tool engineering standpoint, fabrication of the satellite presents a number of problems. Shape and size tolerances are close, and the thinness and relative flexibility of the skin and framework make it mandatory to support all components rigidly during machining operations and assembly, *Fig.* 1. Furthermore, because the satellites are a low-production item, it is desirable to hold tooling to a minimum.

Fabricating the Internal Structure: These problems have been solved, to a large extent, by the use of tools and fixtures which can be utilized for several successive production operations. The internal framework of the satellite, for instance, is welded, *Fig.* 2, annealed and machined, on a single multipurpose fixture, which is also used for final assembly.

Sections of extruded tubing make up the framework proper. These are hot-formed and then assembled and welded together on the fixture. A large ring which frames the access door of the satellite is welded to the bottom of the framework and a smaller flanged "can" is welded to the top. The four antenna sockets are also welded to the framework. All of these components are machined from solid bar stock.

Alternating current is used for welding, with a high-frequency ionization current superimposed over the welding current. An envelope of argon gas shields the arc during welding, preventing oxidation of the molten metal. Assembly and welding operations are followed by annealing to relieve stresses built up during welding.

The major machining operation performed is generating a spherical surface on the flanged ends of

Fig. 2. Framework of satellite after welding. All components are held in place by the rigid fixture. The fixture is disassembled to remove the assembly.

the antenna sockets, corresponding to the curvature of the skin of the satellite. A standard lathe has been extensively modified to perform this operation, *Fig.* 3. One end of the multipurpose fixture is held in the lathe chuck and the other end is supported by a center.

A special toolpost holder, angled away from the work to eliminate interference, is used. The holder is mounted on a rotary table which in turn is mounted on the lathe bed. Adjusting screws make it possible to adjust the table for height and parallelism. These can be locked when the table is in position.

During machining, the table is turned by a small handwheel which operates through a flexible shaft. Thus the cutting tool follows a circular path which conforms to the spherical contour of the satellite skin.

Shaping the Shell: Each hemisphere of the satellite is a two-piece welded assembly, *Fig.* 4. A depression in the hemisphere wall is made by shaping a concave area around the hemisphere. This area is covered by a welded-on ring which gives the outer surface of the shell its regular, spherical shape. The resulting cavity will contain gas or air and will be sealed when the rocket is launched. Reduction in pressure during flight will indicate penetration by meteorites or dust particles.

A drawing operation is the first step in manufacturing the hemisphere. Magnesium sheet stock is heated to 650 F and the draw die, which consists of a form block and two clamping rings, is heated to the same temperature. The shell is formed in a hydraulic press by stretching the blank over the heated form block. After cooling, excess metal is trimmed away.

The drawn hemisphere is essentially a preform; final contours are produced by spinning. The spin block is the same tool which was used as a form block for the drawing operation, another example of multipurpose tooling. Spinning is done in a standard lathe by pressing a wooden tool against the rotating workpiece. This generates accurate curved surfaces, including the concave ring area.

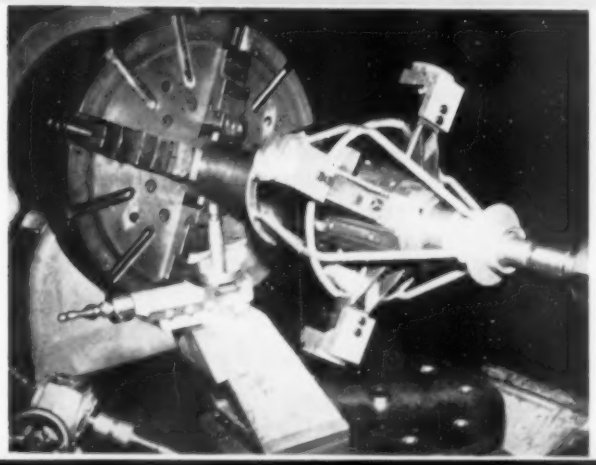
After spinning, the hemisphere is annealed and its external surface is machined. Machining is accomplished in the same lathe used to machine the internal structure of the satellite. The rotary table is again used to sweep the cutting tool through a controlled arc. Because it would be virtually impossible to hold the thin hemisphere for machining by conventional methods, it is heated and shrunk over a tool block similar to the block used for spinning. This holds the hemisphere securely and provides a continuous backup, keeping the metal from flexing under pressure of the cutting tool. In machining, stock thickness is reduced from 0.050 to 0.030 inch, with a tolerance of 0.002 inch. This produces a smooth surface and uniform skin thickness.

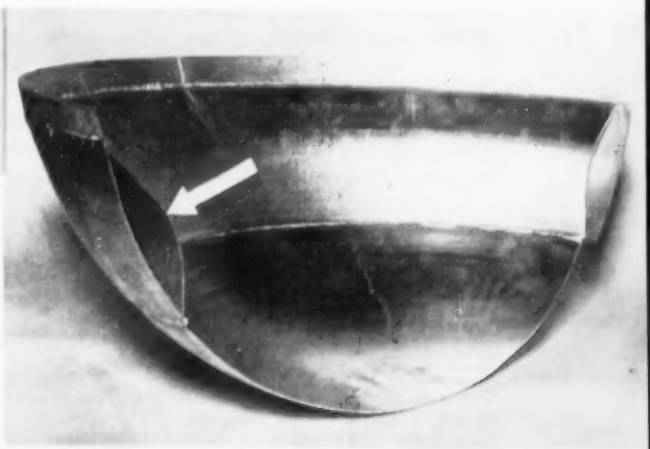
After machining, the ring which makes up the outside wall of the pressurized cavity is welded to the hemisphere. This ring is spun directly from a flat blank and machined to correct size in a series of separate operations. Both hemispheres are polished to a mirror finish and gold-plated subsequent to machining. Some of the internal structural components of the satellite are also gold-plated to resist corrosion.

Final Assembly: Prior to assembly of the two hemispheres to the internal framework, all holes are jig-drilled, with the various components mounted on the multipurpose fixture. After the lower hemisphere is fastened in place, the fixture is disassembled for removal of the satellite and the upper hemisphere is assembled. No difficulty is experienced during assembly. This ease of assembly is the result of holding all parts to close tolerances to eliminate tolerance build-up. Another factor is the use of the multipurpose fixture for all operations on the internal structure of the satellite and during final assembly.

Fig. 3. (below) Satellite framework set up in lathe. Fixture is the same one used for welding.

Fig. 4. (right) Each hemisphere is produced with a hollow wall (arrow) which is pressurized prior to flight of satellite.





HOW to repair and modify plastic tools

By Benjamin Sokol
Supervisor of Nonmetallics
Republic Aviation Corp.
Farmingdale, L. I., N. Y.

This and the following three articles are abstracts of papers to be presented at the 1957 ASTE Annual Meeting at Houston. These papers are typical and indicate the scope of technical discussions.

OF THE MANY PROBLEMS that perpetually plague the tool engineer, the repair and modification of tools are among the worst. One of the best features of tooling with plastics is the relative ease with which repairs and modifications are made, *Fig.* 1. Although plastic tools may not be as strong as their metal equivalents, they lend themselves admirably well to repair and alteration. This is largely due to the excellent adhesive properties of tooling resins.

Basically repairs are determined by two factors: economics and urgency. Under economics are included actual cost of the repair in materials and labor, the number of parts yet to be made on the tool, the original or replacement cost of the tool, and the probability of a successful repair. Under urgency are the time available for the repair and the relative importance of the piece-part involved.

Economics of Tool Repairs

For purposes of estimating, tooling plastics may be assumed to cost one dollar per pound. This figure, of course, varies with the compound used and the source of supply. An average material density of 100 lb per cu ft places the material cost at $100 per cubic foot of tool. Labor and overhead costs will vary and may range from a low of $4 an hour to a high of $10. For the purposes of discussion an arbitrary labor and overhead figure of $7 per hour will be used.

The number of parts yet to be made, after the repair of a tool, may well determine the type of repair. If only a few parts need to be made, a quick-and-dirty repair may suffice. If several thousand parts are needed, however, the repair must be made for the lifetime of the tool. This will be reflected in the cost of the repair.

Since plastic tools are generally much less expensive than metal ones, the question of repair versus replacement of a damaged tool often arises. In many instances it is cheaper to replace a damaged plastic tool than to repair it. In such a case, the cost of the mold for the new tool must be considered as part of the replacement cost.

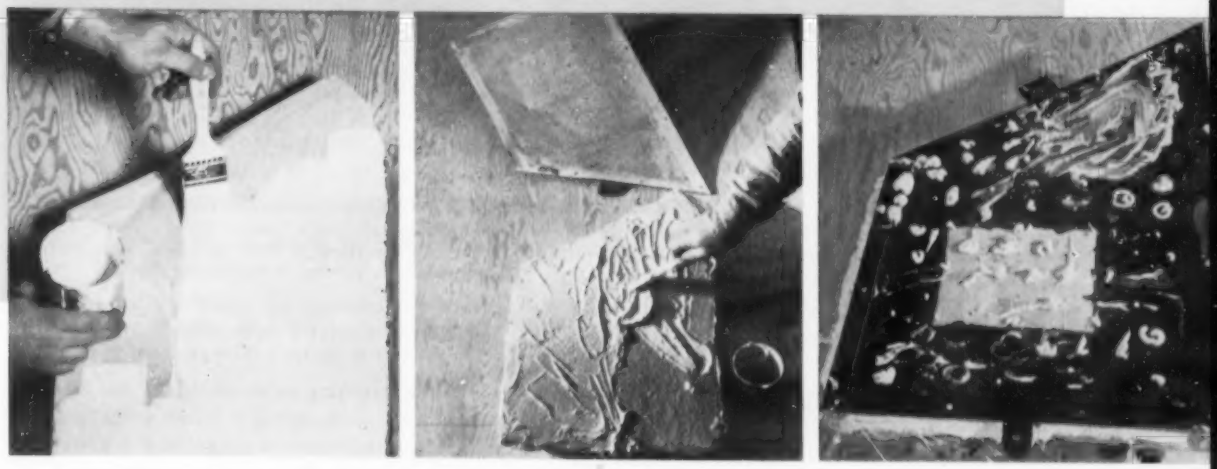
Because of the excellent bonding characteristics of tooling plastics, most repairs are successful. A possibility of unsatisfactory repair always exists and should be considered in estimating costs.

Urgency of Repairs: Just how quickly a damaged tool goes back into production often determines the method of repair. Frequently the necessity of getting the tool back into production immediately will force the tool engineer to choose the quickest rather than the most economical or best method.

Too often the part being made on a plastic tool is a critical component of an assembly so that lack

Abstracted from Paper 37, "Repair and Modification of Plastic Tools," to be presented at the 25th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

Fig. 1. Refacing a routing fixture requires remake of plaster pattern. View *a* shows surface coat epoxy resin being brushed on pattern. View *b*, routing fixture with random holes drilled through is about to be applied to pattern which has two layers of glass cloth and resin over the parting coat. View *c*, fixture is mushed down on pattern so paste and entrapped air are extruded from the bleed holes and around edge of tool.



of it holds up a production line. In these cases, economics are superseded by immediate necessity. The tool engineer should make it a practice to insist on a sufficient allowance of time to adequately plan and accomplish a repair. Rushing a repair job frequently results in poor workmanship and an unsatisfactory result.

Material Considerations in Repairs: Plastic tools may be classified in two categories: cast or laminated. Bulk tools such as draw dies, drop hammer dies, stretch press blocks and form blocks are usually cast, while thin-walled tooling such as drill and trim racks, routing fixtures and spray masks are generally laminated. In some instances the two constructions are combined in one tool.

Because of the amazing versatility of tooling resins, the surface hardness, tensile and compressive strength, toughness, coefficient of expansion, impact strength, temperature resistance, modulus of elasticity, etc., can vary between broad limits depending upon the catalyst system used, method of cure, fillers and reinforcements. One general rule should be followed: when repairing a plastic tool, a material of the same or better than the original physical properties should be used.

When repairing metal-forming tools one property, hardness, must be the same as the original plastic material. The reason for this requirement is to prevent a part formed over the repaired area from being marked at the interface.

Initially, it is essential to evaluate the extent of the damage to a tool and the probable cause. It has been noted that most of the failures are due to one of three things: improper initial design, improper fabrication, or mishandling. Each type of failure will be examined and effective repairs prescribed.

Types of Repairs

Surface pitting of a tool is almost invariably due to air entrapment in the surface resin coat. Slow mixing of the resin prior to application, plus caution in application, will avoid this problem. If a pit-free tool face is necessary, the entire surface should be replaced when more than 5 pits exist per square inch of surface. Probably, if such pitting exists in one area, it will exist throughout. Tapping lightly with a ball-peen hammer will show the faulty areas.

Refacing a Plastic Tool: To resurface the tool, *Fig.* 1, the following steps should be taken:

1. Sand the faulty tool face (60 grit) to remove a fairly uniform ⅛-inch layer. If the tool is laminated, strip off one or two surface layers of cloth instead of sanding.
2. Prepare the surface for refacing with suitable parting agents.
3. Apply surface coat resin and dust the wet coat with a nylon flocking.
4. Allow the surface coat to cure or at least gel. Blow off excess flock.
5. Apply one or two layers of glass fabric to the surface coat resin with a suitable laminating resin. Dust with flock unless proceeding immediately.
6. Liberally apply laminating resin thickened with finely divided silica to the roughened tool face and to the lamination surface. If the tool is a thin-walled laminate, perforate the body laminate with a pattern of ⅜-inch holes to allow for air bleed.
7. Press the roughened tool face into the new face by

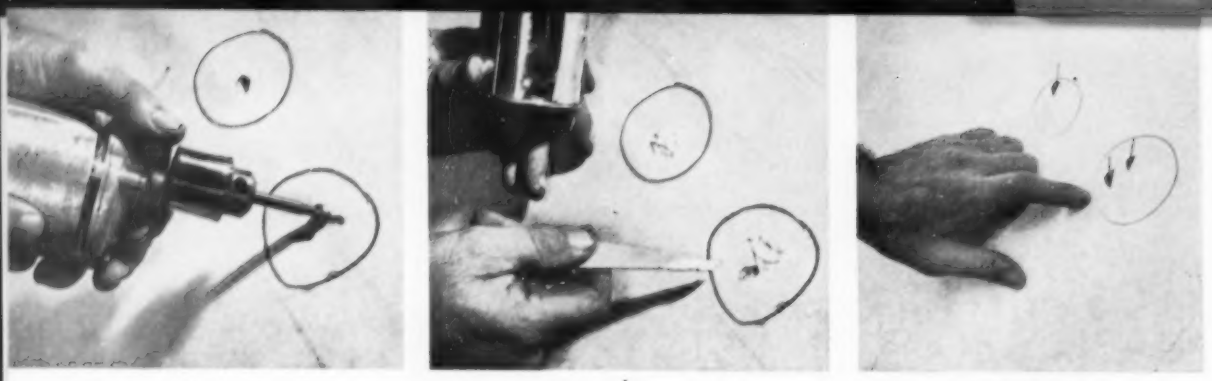


Fig. 2. Repair of minor pits in stretch form after it had produced over 600 skins. View *a*, grinding out pits with rotary file. View *b*, pit holes are filled to overflowing with resin paste. View *c*, after curing, the repaired section is filed to blend with surface. Good repair is almost indistinguishable.

making contact first at one side of the tool and then progressing slowly toward the other, forcing out air and excess resin. Wipe away excess resin.

8. Allow to cure, trim off excess resin and clean up the tool.

Such a repair is both time-consuming and costly but represents the most effective method.

Localized Repairs: Complete resurfacing is usually not necessary. The more common failure is represented by surface break-through of relatively large air bubbles in a few local areas. In this case repairs are quick and simple, requiring only three steps. For instance, three small voids appeared in the face of a large stretch press form, that was in operation for over a year and formed over six hundred aluminum skins. The voids were cleaned and opened up slightly with a rotary file, *Fig.* 2a. Application of surface coat resin, made thixotropic by the addition of a small amount of finely divided silica, is shown in *Fig.* 2b. The resin paste was probed into the prepared void leaving an excess above the required surface. The repaired areas are barely discernible after filing away excess resin, *Fig.* 2c.

Repairing Surface Crushing: If the tool failed in operation due to a general lack of compressive strength of the plastic, then that tool should not have been made of that plastic and no repair should be attempted.

Assuming a local crushing of the tool surface due to high local loading, such as might be caused by wrinkles in sheet metal being drawn in dies, a repair utilizing a cast-in metal plate may be accomplished. The repair may be made as follows:

1. Grind out the crushed area slightly beyond the limits of the damage.
2. Prepare a piece of ¼-inch steel by welding several short steel bolts to the sandblasted back. Shape its face to the area in which it will be located. The bolts will assist keying-in the steel to the plastic.
3. Mix the resin to be used in recasting. Brush some in the ground-out hole and on the underside of the steel insert.
4. Locate the steel insert in its proper location and pour the balance of the resin to fix the insert in place.

If a local crushing of a tool occurs due to carelessness such as dropping a heavy weight on the tool surface, the repair is simple and follows that outlined previously for large air bubbles.

Repairing Fractures, Cracks or Chips: Today, with higher strength and more flexible resins, fractures are infrequent with proper design and usage. In glass-fiber-laminated tooling, fractures are virtually unknown.

Assuming that a cast plastic tool is properly designed for its loads, a fracture might be caused by one of four things: mishandling, overloading, temperature change or poor weathering characteristics of the material. Any tool, regardless of design or construction, may be damaged if mishandled or overloaded. Many tools are made by capping an inch or so of plastic face on a metal core. Unless special precautions are taken, outdoor storage of such tools may result in fractures due to the difference in thermal expansion between the plastic and metal. This is fairly common when the temperature goes below freezing. A heavy brush coat of a flexible resin between the plastic cap and solid metal body of the tool will prevent such cracking. This must be applied when the tool is made.

Certain plastics weather poorly, particularly when exposed to sunlight. If cracking results from poor weathering characteristics of the material, repairs should not be made since they can be, at best, only temporary.

If a tool has been mishandled, steps should be taken to prevent reoccurrences in the future. If the tool has been overloaded and overloading is probable again, the tool should be repaired and modified to take the additional load; if this is not feasible, the tool should be discarded and a new one designed and built.

Plastic tools stored outdoors should be brought to room temperature before being put to use. A cold (0 F) plastic drop hammer die will shatter

like glass if mounted and operated cold.

Repair of fractured cast tools is generally simple, *Fig.* 3a. The following is how this typical repair was made on the phenolic resin tool:

1. The tool was first washed with solvent to remove oil and grime from the working areas.
2. The cracked areas were opened up and the cracks ground away.
3. The cracked openings were closed with cloth masking tape and a clay dam built to form pouring sprues. The loose tooling hole bushing lug was located in place.
4. Epoxy resin was mixed and poured into the sprues.
5. After the resin cured, the tape and clay were removed, the excess resin filed off, and the tool went back into service.

The cost of the repair was: materials, 50 cents; labor, 3 man-hours; total cost, $21.50. Total elapsed time was six hours.

Warpage Repairs: Occasionally, a tool that has been made in an apparently satisfactory manner will develop warpage. Warpage is a shortcoming in plastic tooling that can be most exasperating and costly. If a tool warps early in its life, the loss will be minimized. If the tool does not exhibit warp until several months have passed, the loss may be compounded due to the production of many parts or other tools based on the faulty one. Sometimes a trim and contour checking tool of considerable length may warp due to metal distortion. In one such instance, it was found that the welded tubular steel body of the tool was not normalized before tie-in of the plastic face band. Progressive relaxation of the steel warped the plastic. The rework is as follows:

1. Remove the plastic face band from the tool and normalize the welded steel tubular structure.
2. Laminate a new plastic face band against the master tool.
3. Tie in the plastic to the steel in the same manner as before.
4. Remove from master and clean up tool.

Total cost of rework: material, $10; labor and overhead, $112; total cost, $122. Of course no estimate can be made of the loss due to faulty parts and work stoppage.

Few warped plastic tools can trace their troubles to metal distortion, however. Four out of five cases are due to either plastic creep or differences in plastic-to-metal thermal expansion.

When the warpage is traced to creep in the plastic tooling material itself, it will usually be found that the tool is all plastic and that it was made with too scanty a cross-section. For general purposes, a span-depth ratio of 8:1 should be held. Before attempting to repair a creep-warped tool, the tool should be heated to a temperature of 40 to 50 F higher than its anticipated highest operating temperature and allowed to cure at that temperature from 6 to 8 hours. The prolonged high-temperature cure will reduce the creep tendency to a safe minimum. After cooling the tool to room temperature, the repair, generally a refacing of the working face, as previously outlined, should be made.

Warpage due to thermal expansion incompatibility between plastic and metal parts of a tool is serious trouble, usually indicating complete loss of the tool. If there must be contact, a thin flexible layer of resin must interface the two to take up the differential expansion and compression stresses. At this point economics must decide whether to scrap the tool and start over or to strip and replace the plastic.

Rather rare is warpage due to shrinkage of the plastic. Today's resins, particularly the medium-high viscosity epoxies, exhibit a low degree of apparent shrink. When clear resins are heavily filled, shrink is drastically reduced. If filled material is further laminated with glass cloth or other reinforcements, shrink is essentially nil. When a tool is determined to be warped due to resin shrink, usually at the time it is removed from its mold, the simplest alternative is to high-temperature cure and then reface it.

Loosening of Components: Small components such as bushings, locating pins, mounting lugs and steel routing edges occasionally loosen. If the cause is accidental high-impact or misuse that will probably not recur, repair is to merely rough up the surfaces to be rejoined, and rebond with epoxy resin. If, however, the failure is due to unexpected operating conditions and will probably occur again, a different approach must be made.

Metal bushings that come loose from plastic tools do so for one of three reasons: heat in drilling, impact, or plastic creep due to continued high unit loading. The first is the result of the rubbing of a rapidly rotating drill and chips. This is repaired by preparing a bushing with a $\frac{1}{8}$ to $\frac{1}{4}$-inch ceramic coating and epoxy-bonding it back in location. For small bushings an alternative is to use bushings equipped with metal tabs that may be riveted to the body of the tool and thus hold the bushing in proper orientation. Bushings that are knocked out of their mountings generally are of improper design. Bushings with hexagonal or square mid-sections for mounting are available and will alleviate the problem.

When a bushing is heavily loaded in one direction for a long period of time, the plastic surrounding it will creep and the bushing will loosen. To prevent the recurrence of this, in repairing the tool the area surrounding the bushing should be "beefed up" to better distribute the load.

Fixed locating pins that must be replaced due to breakage, bending or other reasons are handled in

Fig. 3. Cast phenolic stretch press block which failed after three years of service and intermittent storage. View *a*, cracked areas washed free of oil and grit and ground out with rotary file. View *b*, cracked area is dammed with cloth masking tape and clay. Clay pouring spout is formed and filled epoxy resin is slowly poured into crack cavities. View *c*, finished job after cleanup of repair.

much the same way as bushings. Care should be taken to see that the pin has a flared-out or knurled area to afford a mechanical key in the plastic tool.

Mounting lugs and steel edges are occasionally damaged and require repair or replacement. In replacement, arrangements should be made for mechanical keying to the plastic. Bonding alone should not be expected to hold the metal through tough service. The metal parts should be roughed up by sandblasting or other means on the side being bonded to the plastic. In addition, internal mechanical keying or external machine screws should be used.

Worn Areas: Normal wear is nonuniform in character; certain areas will wear away more than others. In draw dies, the radii suffer first while in drop hammer dies it is the sheet metal edge and wrinkle areas. Occasionally, certain sections of a tool are worn abnormally due to misuse. An example of this is a gouge that results from prying a formed metal part off a plastic die with a king-size screwdriver.

Repairs to small surface areas can be made as indicated previously. Where larger areas or difficult contours are concerned, it becomes necessary to remold against a reference surface. This is done by roughing back the tool and replacing the face as previously outlined.

Modification of Plastic Tools

The modification of tools may be considered as a type of repair. In an ordinary repair job the tool is reworked to perform its original function. In a modification the tool is reworked to perform another job. Examples of typical modifications are:

1. Addition Modifications
   a. More hole locations added to a drill rack.
   b. A change in contour added to a checking fixture.
   c. A routing fixture lengthened to accommodate a longer part.
2. Subtraction Modifications
   a. Plug hole locations in a drill rack.
   b. Remove trap beads from a drop hammer die.
   c. Shorten a trim template to accommodate a shorter part.
3. Change of Operation Modifications
   a. A hand routing template altered to become a spot welding fixture.
   b. A checking fixture altered to become an assembly fixture.

When a tool is modified, it is done so in lieu of replacement by a new tool. If the modification promises to be a costly one, replacement should be considered. In general, subtraction modifications are inexpensive to perform and rarely cause concern. On the other hand, change of operation and addition modifications can be difficult and expensive to complete. How then decide when to modify and when to replace a plastic tool? As with repairs, "economics" and "urgency" determine this, and each case must be viewed individually. The same basic governing factors apply to all types of plastic tool alterations.

In conclusion, it can be stated that, armed with the excellent plastic tooling resins available today, quick, inexpensive and successful tool repair or modification is usually entirely feasible.

TITANIUM CHIPS

can be broken easily

By Jens L. Wennberg
Ensign, USNR
Naval Harbor Defense Unit LOSA
Long Beach, Calif.

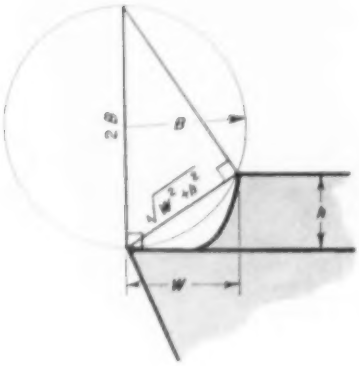
BECAUSE TITANIUM has been a problem metal in many respects, it was anticipated that research into chip breakers for titanium would result in useful information and would serve as a check on previous investigations of other metals. As cutting speeds have increased, the control of metal chips has become more important. Straight chips or chip snarls are a hazard to the operator and can damage surface finish. They are hard to handle and store because of their volume, and their sales value is less than that of compact chips. Because of these problems, a satisfactory method for controlling the flow and shape of chips is a necessity. It has been found that by controlling cutting speeds, and feeds, and using a suitable chip breaker, titanium chips can be tamed.

Chip breakers, ground or clamped, have been successfully applied in high-speed cutting operations. Chip breaker dimensions and positioning are critical and much data have been published on them. The data have been incomplete, however, because insufficient attention was paid to the effects of chip breaker height, depth of cut, tool angle, cutting speed and workpiece material. As investigation of chip breakers progressed, it was determined that the radius of bending formed in the chip was of paramount importance. Relationships between this radius and the feed rate were developed.

In order to determine the success of a given chip breaker and a specific set of machining conditions, chip forms must be classified. With titanium, under specific conditions, a straight chip will be produced. If all other conditions remain constant while the feed is increased, the character of the chip shape will progress as follows: snarl, infinite connected figure 9's, intermittent connected figure 9's, full turns, half turns, and splinters and fragments.

Because of the possible effect of chip type on tool life, power consumption and surface quality, it was arbitrarily decided that preferred chip forms are intermittent connected figure 9's and full turns; usable forms are infinite connected figure 9's and loose half-turns; and undesirable forms are snarl,

Abstracted from Paper 8, "Chip Breaking Characteristics of Titanium," to be presented at the 25th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.



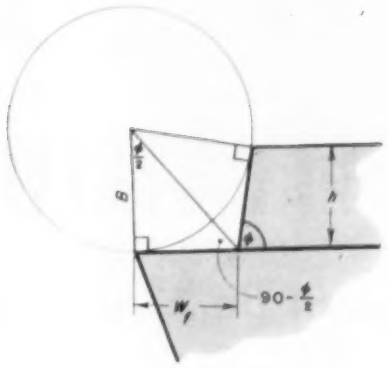


Fig. 1. (left) Dimensions that apply to a ground chip breaker.

Fig. 2. (right) Dimensions that apply to a clamped chip breaker, either adjustable or nonadjustable type.

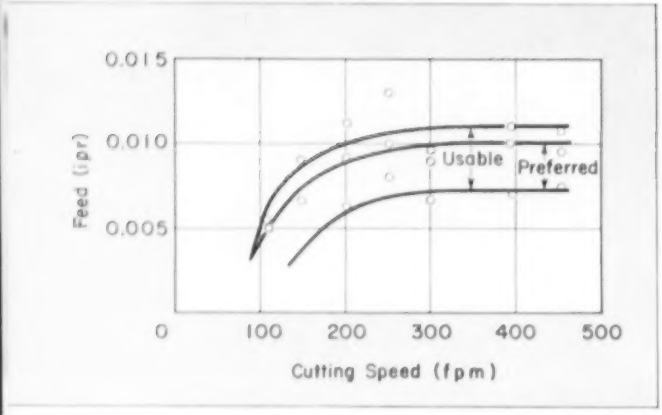


Fig. 3. Speed curves, indicating preferred and usable chip ranges, for 1045 steel. The depth of cut was 0.125 inch and the bending radius was 0.268 inch.

straight, tight half-turns, fragments and splinters.

Relationships between feed and radius of bending have previously been established for B1112, 1015 and 1045 steels. Despite their different chemical analyses and mechanical properties, these steels have remarkably similar chip breaking characteristics. The current study was also done on three materials: 1045 steel and 303 stainless—to determine if general conclusions could be drawn from previous work—and commercially pure titanium. Stainless steel was also selected because of its similar work-hardening characteristics to titanium.

Analytical Procedure: The radius of bending can be determined from one of two equations, depending on the type of chip breaker. If the chip breaker is ground, *Fig.* 1, the Copenhagen formula is used:

$$B = \frac{W^2}{2h} + \frac{h}{2} \quad \text{.....(1)}$$

where

B = radius of bending, inch
h = height of chip breaker, inch
W = tool face width, inch

If a clamped chip breaker, *Fig.* 2, is used, the Missouri formula applies:

$$B = \frac{W_f}{\tan\frac{\phi}{2}} \quad \text{.....(2)}$$

where

W_f = tool face width, inch
ϕ = chip breaker angle, inch

If, with a clamped chip breaker, length W_f is less than $h/\sin\phi$, the chip will hit the corner rather than the face of the chip breaker. For such a condition, Equation 1 should be used in determining the radius of bending.

To calculate the dimensions of a clamped chip breaker to result in a desired chip bending radius, the angle is assumed to be 40 to 50 deg and Equation 2 is solved for W_f. Charts for finding the height and tool face width for a ground chip breaker, to result in a particular chip bending radius, have been widely published.

Test Procedure: To check the chip breaking characteristics of 1045 steel, the relation of cutting speed and feed to the form of chip produced was considered most important. This relation encompasses a larger variety of cutting conditions than any other simple combination of variables. The cutting tool geometry was: back and side rake, —7 deg; side-cutting and end-cutting edge angles, 5 deg; and side and end relief, 7 deg. The nonadjustable clamped chip breaker had an angle of 45 deg and was ground so that $W_f = 0.111$ inch. Bending radius of the chips was 0.268 inch.

To determine the possible effect of speed on chip breaking, the feeds at the points of transition from usable to preferred ranges, etc., were recorded at different speeds with the same chip breaker. The results of the test are shown in *Fig.* 3.

Because of good correlation between these results and those of previous work, 303 stainless was tested in the same manner. The cutting tool geom-

etry was: back rake, 0 deg; side rake, 5 deg; side-cutting and end-cutting edge angles, 5 deg; and side and end relief, 5 deg. The clamped chip breaker had an angle of 55 deg 25 min and was adjusted so that $W_f = 0.175$.
Bending radius of the chips was 0.334 inch. The results of these tests, *Fig.* 4, show a complete reversal of trends when compared with 1015 steel. Reasons for this reversal will be discussed later.

Similar tests on titanium, with a tool similar to that used for 1015 steel and a nonadjustable clamped chip breaker ground to give ranges for W_f between 0.149 and 0.032, and B between 0.360 and 0.078 with an angle of 45 deg, gave results, *Fig.* 5, similar to those with stainless steel.

This series of tests gave the maximum amount of information on chip breaking behavior but, since there were two distinct trends noted, it was decided to test 1015 steel and titanium with another set of conditions. The second relation was between feed and radius of bending at a constant speed. Results of such tests give valuable information for tool design and shop operations. Tests were run with chip breakers adjusted to give several different radii of bending. Results are plotted in *Fig.* 6.

Discussion: These tests indicate that there are at least two different types of chip breaking behavior based on reaction to speed. With carbon or low-alloy steels, breaking of chips is more difficult as the speed increases. This is true because, at low speeds, the chip is naturally segmental before it gets to the chip breaker. As speed increases, the chip becomes continuous and ceases to have a tendency to break. Also, chips are thicker at low speeds. This has the same effect as increasing the feed since feed determines the chip thickness. These two phenomena cause the chip to break at lower feeds than would be expected at low speeds.

Stainless steel and titanium show a reversed reaction to speed in the slow speed range. With titanium, the chip-breaking feed increases as the speed decreases. It was also found, *Fig.* 7, that titanium chip thickness increases as the speed decreases, though not to the same extent as has been noted for several carbon steels.

Both stainless steel and titanium are extremely subject to work hardening. Thick chips at low speeds are subject to more deformation, so they are work hardened to a greater extent than thinner chips. As a result of the work hardening, the chips are stronger and harder to break. This characteristic offsets the other factors affecting carbon and low-alloy steel chip breaking. In addition, stainless and titanium have low coefficients of thermal conduction. This means that the chips have a higher temperature than chips of carbon or low-alloy steel produced under similar cutting conditions. At high

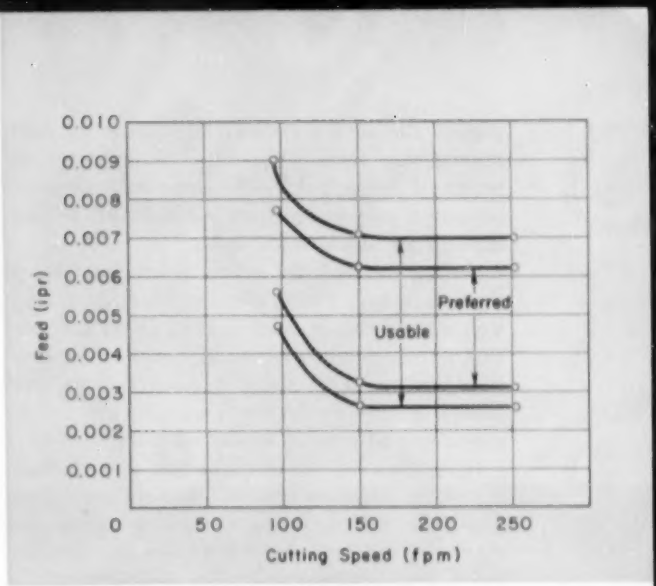


Fig. 4. Speed curves for type 303 stainless steel. Depth of cut was 0.125 inch and the bending radius was 0.334 inch.

cutting speeds, the chip temperature can build up to a point where the chip is partially annealed. Such partial annealing reduces the strength of the chip so that it can be broken more easily at high speeds.

Importance of the presence of segmental or partially segmental chips should not be overlooked. Introduction of a vibration, intentionally or unintentionally, changes the whole picture. Chips formed in the presence of vibration, or chatter, look similar to segmental chips and the feed required to form a certain type of chatter chip is similar to that required for the same type of segmental chip in ordinary steels at low speeds. This shows that if working conditions permitted the introduction of chatter, the useful range of a chip breaker would be widened. However, vibrations generally decrease tool life.

Titanium chips are stringy and tend to hold to-

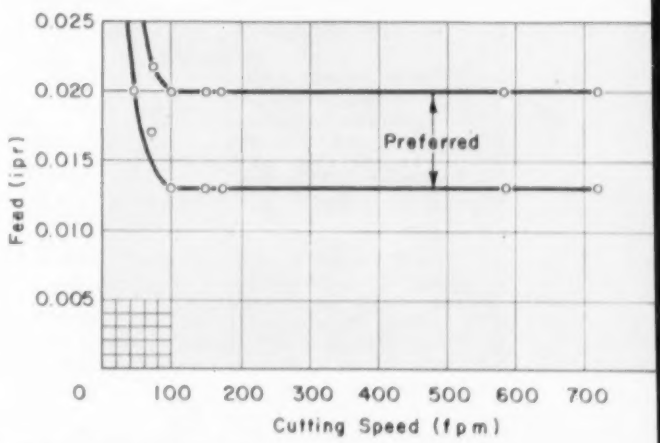


Fig. 5. Speed curves for titanium 75a determined with depth of cut of 0.100 inch and chip bending radius of 0.200 inch.

gether. The most prevalent chip type is the intermittent chip form composed of three to ten unseparated figure 9 chips. When figure 9 chips are separated, they usually are accompanied by half turns, some of which are tight.

During the feed and radius of bending tests on titanium, a large (0.043 ipr) feed was used in error with a small chip breaker. Instead of being ejected as fragments and splinters, as would be expected with ordinary steel, the chip hung together long enough to be cold welded into one piece that had the appearance of a finely segmented chip.

Although a reversal of chip breaking characteristics was noted for stainless and titanium in the speed curve, the feed vs. radius of bending curves were the same, qualitatively. The curves for titanium, *Fig.* 6, are higher and the usable range is somewhat smaller for common feeds. This means that accurate chip breaker dimensions and position are more important with titanium than with ordinary steel. From these same curves, it can be seen that a chip breaker will not give properly broken chips from different metals at the same cutting speed.

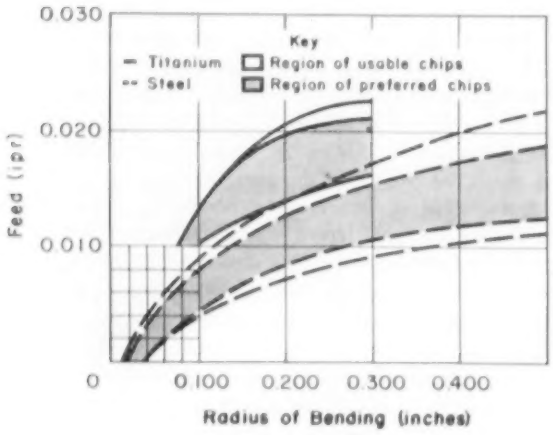
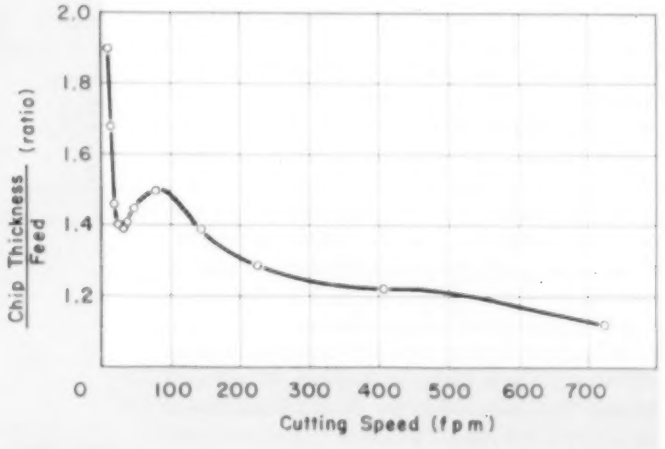


Fig. 6. (above) Radius of bending curves showing the relative position of titanium 75a and 1015 steel in chip breaking characteristics.

Fig. 7. (right) Ratio of chip thickness to feed vs. speed curve when cutting titanium 75a with a feed of 0.0179 inch. Plotted points are averaged measurements taken with a thread micrometer.



Application of Findings: The use of the curves found from this study can most easily be demonstrated by a practical example. Assume that it is desired to cut titanium (Ti75a) at 75 sfpm, with 0.1-inch depth of cut and a feed of 0.018 ipr in a setup using a clamped chip breaker having an angle of 45 deg. Where should the chip breaker be positioned?

Reference to *Fig.* 5 shows that the cutting speed at the feed is not within the flat portion of the curve so a speed correction is necessary. Since the desired conditions more closely match the top curve, it will be used. The feed modification factor for speed is found by dividing the ordinate of the flat portion by the ordinate of the required speed. In this case, the feed modification factor is $0.020 - 0.02125 = 0.941$. To obtain the feed to be used in *Fig.* 6, the actual feed is multiplied by the modification factor. The modified feed thus is 0.0169.

This value is used with *Fig.* 6. The feed ordinate of 0.169 is followed to the right to the point where it is equidistant from the boundary curves of the preferred chip region. The value of B, about 0.175, is read under this point and is used in Equation 2 to determine the value of W_f, 0.072 inch in this instance. The chip breaker is adjusted to this position or, if it is of the nonadjustable type, is ground back to this point while maintaining the 45-deg angle.

Acknowledgements:

The author thanks the College of Engineering of the University of Missouri for the opportunity to do this research, and the Titanium Metal Corp. of America, Watertown Arsenal, Kennametal Co., Viking Tool Co., Vascoloy-Ramet Tool Co., MacDonald Aircraft Co. and Pratt Whitney Aircraft Co. for help in giving material, tools and advice for this project. He also thanks E. K. Henriksen for encouragement and guidance.

Experimenting with Ceramic Applications

. . . case studies of ceramic cutting tools as applied to production jobs

By J. F. Allen

Factory Manager
Cameron Iron Works, Inc.
Houston, Texas

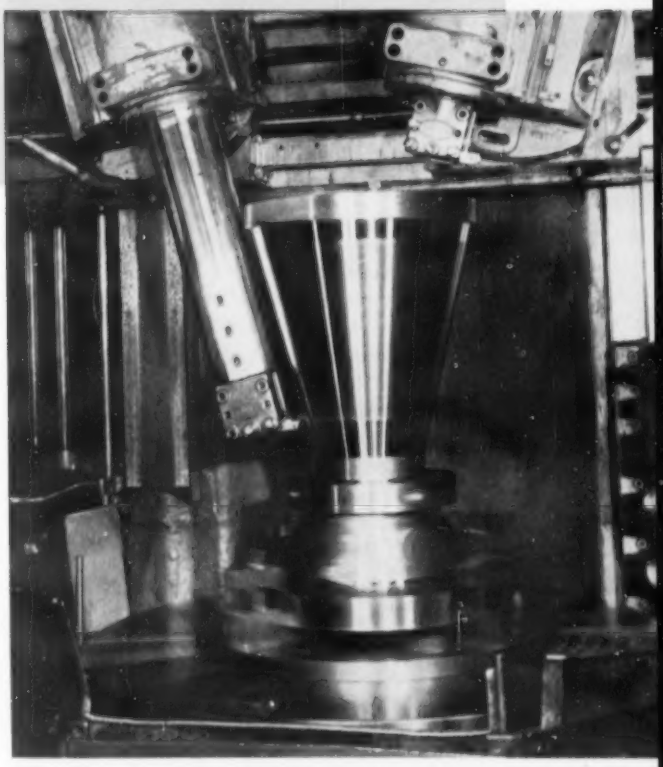


Fig. 1. Turning the outside diameter of an alloy steel missile nozzle. Boring arm, upper right, has just completed finish boring the inside diameter.

ALUMINUM OXIDE cutting tools have recently aroused the interest of practically everyone in metalworking, especially those faced with the responsibility of increasing output, improving quality and reducing manufacturing costs. To date, this interest has been centered around a relatively few isolated case histories where ceramic cutters have been successfully used. Such case histories provide nothing more than a starting point and can by no means be taken as an indication that ceramic cutters can be put into general use without first trying test applications. Through such tests, the Cameron Iron Works was able to determine what production jobs could be handled by ceramic cutting tools.

Finishing Operations

Early experimentation showed that the success of ceramic finishing tools was practically assured by following fairly simple rules of use. First, the machine tool must have ample spindle speed and power, and must be free from excessive vibration. Second, the cutter must be well supported with a minimum of overhang. Third, sudden shocks must be carefully avoided.

Ceramics were first tried for finishing a combination taper and straight bore of a forged-steel casing head housing. The material was AISI 4130 forged steel, heat treated to a hardness of about 200 Bhn. Best results were obtained using a cutting speed of 800 fpm, 0.017-inch feed per revolution and 0.020-inch depth of cut. Several cuts were taken at the top speed of the machine—giving a cutting speed of 1100 fpm—but premature chipping of the ceramic tip resulted. It was felt that this might be

Abstracted from Paper 22, "Ceramic Cutting Tools Applied to Production Jobs," to be presented at the 25th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

due to repeated impact on the tip of chips that were retained, by centrifugal force, against the inside of the rapidly rotating housing.

At 300 fpm, the time required for this cut was reduced from 4 minutes to 1½ minutes, using a ceramic tip in place of a general-purpose grade carbide tip. A standard clamp-on type of cutter holder, having 5-deg negative back and side rake angles, was used with a square ceramic insert. Cutter life was found to be rather indeterminate since failure of the cutting edge always occurred by chipping rather than wear. In all instances, little wear was observed, usually amounting to a 0.003 to 0.008-inch wear land at the time the tip had to be indexed because of failure by chipping. As many as 25 pieces could be finished with the four edges of one tip.

Finish boring the inside diameter of a forged steel missile nozzle was the second application. Best results, in this case, were obtained with the machine running at its top speed of 160 rpm, resulting in cutting speeds which ranged from 360 fpm at the smallest diameter of the taper bore to 900 fpm at the largest diameter. Depth of cut was 0.025 inch and feed per revolution was 0.015 inch. It was felt that if the machine could have been run faster, production could have been successfully increased in direct proportion. Time for this cut was reduced from 15.8 minutes to 10.4 minutes by replacing carbide with a ceramic. Finish was improved; consequently, the final buffing operation on the nozzle was reduced by 30 minutes.

Following the inside boring operation, a finish cut, *Fig.* 1, was taken on the outside diameter of the missile nozzle. This cut was also taken at 160-rpm. Cutting speeds ranged from 432 fpm to 880 fpm. Depth of cut in this case was 0.085 inch and feed per revolution was 0.015 inch. Time for this cut was reduced from 13½ minutes to 9 minutes by using the ceramic tip in place of a carbide tip.

If ceramics can be successfully applied to such finishing cuts, the question naturally arises as to why all finishing cuts should not be taken with ceramic cutters. The answer to this question requires an appraisal of each job. The machine must have ample speed; there must be no vibration and there must be no interrupted cuts. Also, length of cut in the finishing operation should be of sufficient duration to actually result in a time saving of some consequence. For example, if, after all the roughing work has been done, the finishing cut is of extremely short duration and requires the shifting of gears to gain sufficient ceramic cutting speed, in all probability, the reduction in over-all floor-to-floor time for the part would be insignificant.

Semiroughing Operations

Having successfully applied ceramic tips to finishing cuts, it was decided to try a light cut on a part having an "as forged" surface. The part seleclected was a forged steel flange, *Fig.* 2. The cut was taken at 613 rpm, resulting in a maximum cutting speed of 1200 fpm. Depth of cut was 0.125 inch and feed per revolution was 0.018 inch. The holder used was a standard clamp-on type, using a square ceramic insert set at 5-deg negative back and side rake angles. Both faces and the OD of this flange were finish machined with this cutter.

It was possible to finish an average of 16 pieces per ceramic tip, using all four cutting edges. In addition to the operation performed by the ceramic

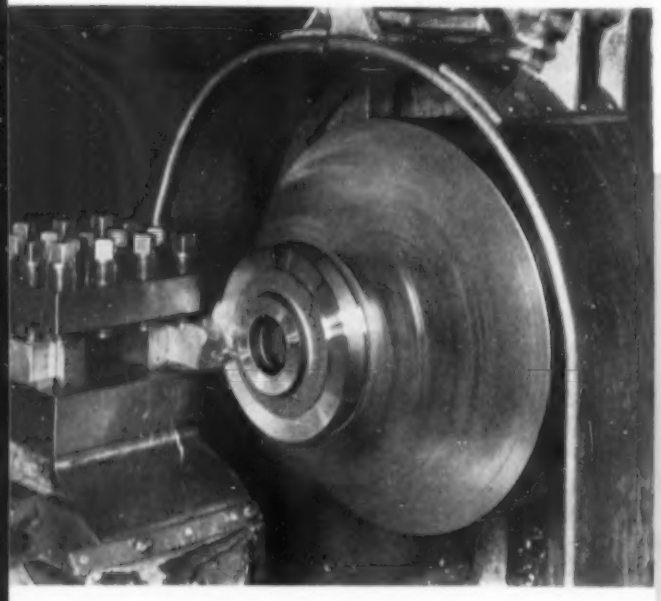
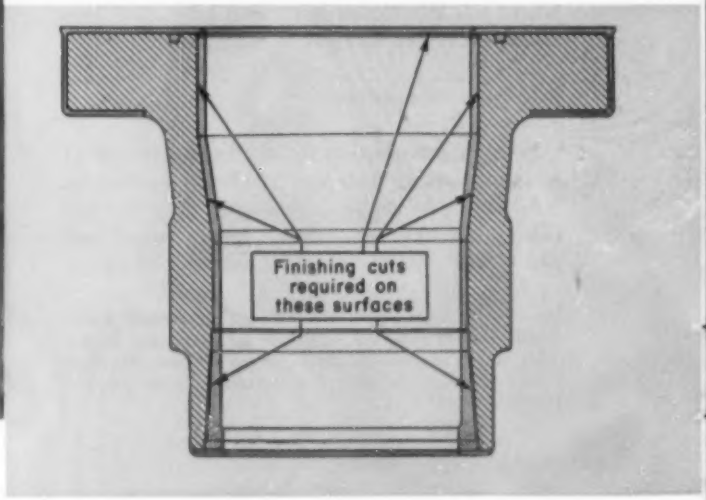


Fig. 2. (left) Alloy steel flange forging with an "as forged" surface. This forging is being machined to size in one pass, using a ceramic cutting tip.

Fig. 3. (below) Sectional view of forged steel casing head housing showing amount of stock to be removed in first and second machining operations.



cutter which required only 47 seconds, this part was threaded and the seal ring groove added by conventional means. Those operations performed by the ceramic cutter in 47 seconds normally require four times this amount of time, using carbide cutters. This application proved moderately successful, particularly in view of the condition of the surface presented to the cutter. Since this part was made from a hammer forging, however, the surface was fairly uniform and resulted in a fairly constant depth of cut.

Roughing Operations

Consideration of ceramics as finishing cutters only would place a severe limitation on their effectiveness in a shop where roughing cuts are predominant. Therefore, extension of ceramic cutters into the area of heavy roughing cuts is extremely desirable.

Amounts of metal that must be removed from the casing head housing that was finish machined in the first test are shown in *Fig.* 3.

If it were possible to remove all of the metal shown at a rate in the neighborhood of 300 fpm, then total floor-to-floor time for the first operation could be reduced approximately 115 percent.

It was quite obvious, then, that the next step in this application program was to attempt the use of ceramic cutters on roughing cuts. The first attempt was to remove a ¼-inch depth of metal from a rough forging, using a cutting speed of approximately 450 fpm and feeds ranging from 0.012 to 0.030 ipr. Results of this and all similar tests were discouraging. Triangular inserts were used for these tests. A number of ideas were tried, including rather drastic changes in rake angles, severe honing of the cutter's edge, shot blasting of the "as forged" surfaces and various nose radii. None of the above attempts resulted in much improvement, though some observations were made which indicated a possibility for improvement.

It was observed that the portion of the tip which was buried in the cut suffered little or no damage. However, that portion of the tip which was left exposed to the impact of metal chips, *Fig.* 4, became severely damaged. It was logical to assume that this severe damage to the edge of the ceramic tip provided an excellent source of initial cracking, which could easily be propagated through to that part of the tip doing the cutting, resulting in complete failure by breakage. As yet, there is no definite proof to support this hypothesis. However, this idea suggested a means of protecting the exposed portion of the tip from the metal chips, *Fig.* 5. A tip protector was so designed and located that only that part of the tip which would actually be doing the cutting was left uncovered.

Use of this device has resulted in a considerable extension of cutter life in a number of instances. For the best results this tip protector must be designed for a specific depth of cut. The use of the tip protector did not, however, furnish a complete solution to the problem of cutting the rough "as forged" surfaces. Since there is always a certain amount of nonuniformity on these surfaces, the cutting edge is continuously subjected to a varying depth of cut. That portion of the tip which is in contact with the so-called scale line disintegrates rapidly. Remembering that some degrees of success was obtained when machining the hammer forging, *Fig.* 2, it appeared that damage to the tip at the scale line was not caused so much from scale as it was from the varying depth of cut which causes the scale line to traverse back and forth along the edge of the tip.

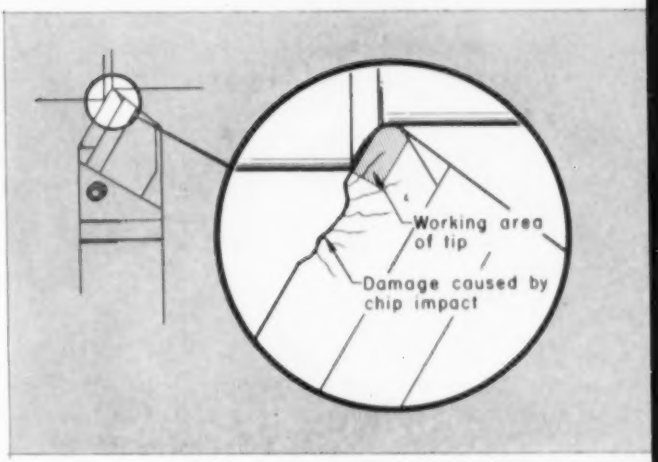


Fig. 4. Sketch indicating hypothetical condition of chip impact damage, causing cracking in the working area of the tip.

Using the tip protector, a taper turning cut was taken on an AISI 4132 steel forging. A standard clamp-on type toolholder was used with a triangular ceramic insert having 5-deg negative back and side rake and a lead angle of 30 deg. Best results were obtained when run at 1130 fpm with 0.012-inch feed per revolution and 0.125-inch depth of cut. Five passes were required, the last pass being at 0.0312-inch depth of cut in order to finish to the correct diameter. In spite of the multiple passes, this operation was finished in 3.17 minutes, compared with the previous time of 10.26 minutes with a tungsten-carbide cutter requiring three passes.

In machining a shaft, the second of a series of cuts was taken with a ceramic tip, using the tip protector. Cutting speed 800 fpm; depth of cut, 0.1875 inch; and feed per revolution, 0.015 inch. Total cutting time for three passes with a ceramic tip was 39 minutes. This represented a saving of 33 minutes over the original cutting time of 72 minutes required with a carbide cutter making two passes at 300 fpm.

The fair amount of success with moderately heavy cuts, which did not involve the removal of rough forged surfaces, is an indication that ceramic tips should prove successful where more than one roughing cut may be required for stock removal.

Following this procedure, a test cut was taken on a forging where the first cut had been taken with a tungsten-carbide cutter. The cut was made at 1400 fpm with a 0.1875-inch depth and 0.017 ipr feed. The length of cut was 20 inches and the tip appeared to have no more than a 0.005-inch wear land at the end of four such cuts.

This ability to remove moderately heavy amounts of stock on second and subsequent roughing cuts does not materially increase the effectiveness of ceramic cutters. Most of the forgings processed require the removal of about ¼ inch of stock and, since a carbide tool can remove this in one pass and leave a satisfactory finish, there would be no point in limiting the carbide cut solely for the purpose of allowing the ceramic cutter to be used on unnecessary second roughing cuts.

One application of particular interest concerned machining alloys which are extremely difficult to machine. Recently, the Cameron Iron Works received a request from the Rice Institute of Houston, Texas, to assist them in the machining of a special part for use in their electronic laboratory. The part was made of an alloy of iron, cobalt and vanadium, and all previous attempts to machine the part with carbide cutters were unsuccessful in spite of the fact that the hardness was only 20 R_c. Carbide cutters burned soon after becoming engaged in the cut. A lot of heat developed which warped the part beyond the close tolerances required. Using a ceramic tip, *Fig.* 6, the workpiece was machined at the relatively low speed of 150 rpm. Cutting speed ranged from 440 to 230 fpm along the taper. The depth of cut was 0.050 inch and the feed per revolution was 0.007 inch, producing the fine finish required. This did not set any production record since only one part was machined, but it is an example of an instance where the ceramic tip did a job that was practically impossible with carbides.

Continued experimentation with ceramic tools applied to production jobs will result in two benefits. In the first place, shortcomings of present materials will be better recognized and lead to the development of still better materials. Fortunately, ceramic tools "chalk" when they fail, leaving the workpiece undamaged. The second benefit will be the development of a better understanding of the metal-cutting process. There is no doubt that the development of better techniques, which are absolutely necessary to the successful use of ceramic cutters, will lead to an improved use of carbide cutters as well.

In this age where speed and quick results have become standards rather than aims, there is a natural tendency to abandon any new material that doesn't give immediate successful results. Expecting too much too soon from ceramic cutters will result in negative reaction and possible rejection. This can greatly impede the successful development of ceramic cutter use. The person who claims that the ceramic cutter is a cure-all will do it a great injustice. It is necessary to experiment and find ways of extending the use of the ceramic cutter into the area of heavy, rough machining cuts if at all possible. If efforts along this line are successful, there is no doubt that industry will feel the greatest impact it has experienced since the advent of the carbide tools.

Acknowledgments

The author wishes to acknowledge the work performed by Mr. L. J. Kerley of Cameron Iron Works in carrying out the program of ceramic cutter application and also to acknowledge the helpfulness of the several manufacturers of ceramic cutting materials in supplying ample quantities of cutting tips for use in this program.

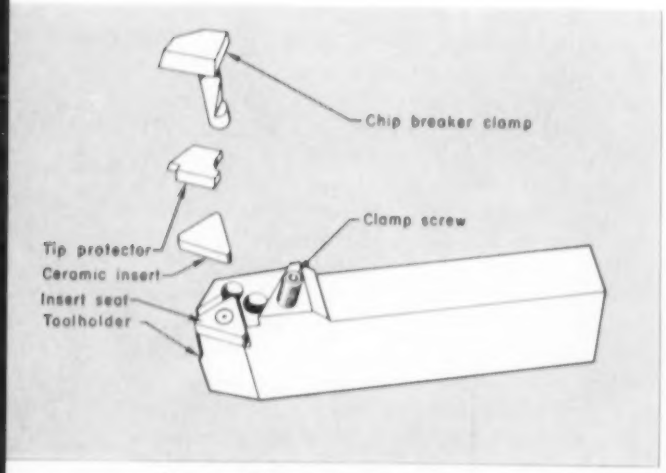


Fig. 5. (above) Exploded view of toolholder and insert showing relative positions of ceramic insert, tip protector and chip breaker clamp.

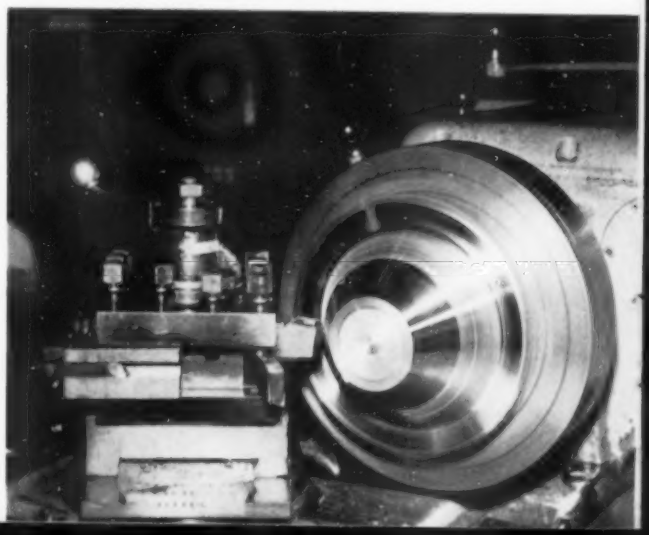


Fig. 6. (right) Taper turning cut with a ceramic tip on an alloy of iron, cobalt and vanadium which defied previous attempts to machine with carbides.

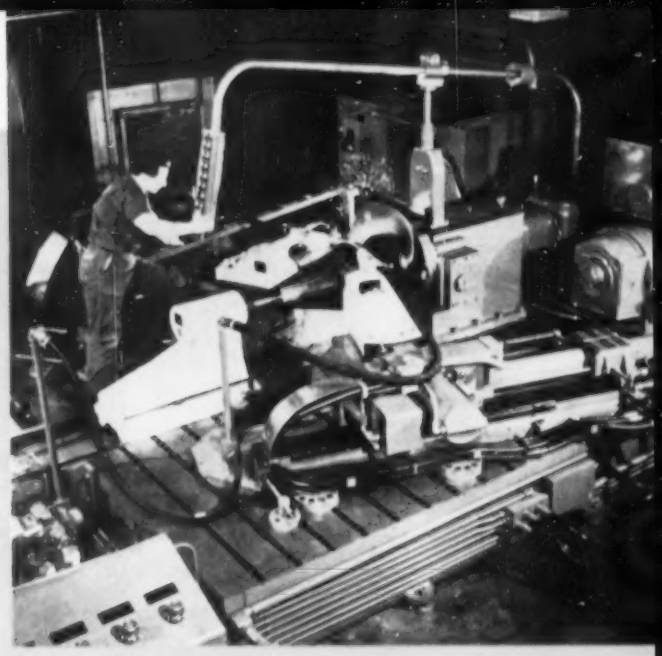


Fig. 1. Power roll forming machine producing a conical shape to accurate specifications.

POWER ROLL FORMING

cuts production costs

By J. W. Bergman
Manufacturing Engineer
General Electric Co.
Cincinnati, Ohio

POWER ROLL FORMING is a process for forming sheet stock or preformed blanks against a rotating mandrel. As the workpiece and the mandrel revolve, two hardened rollers traverse the length of the workpiece at a preset distance from the mandrel, thus forming the workpiece, *Fig.* 1.

In this type of forming, metal is actually displaced by shear deformation and the metal thickness of the original blank is reduced by a predetermined amount. Some variation (± 10 percent) in the thickness of the rolled wall of the cone can be achieved by adjustment of the roller path, or by changing the angle of the slide. This can be accomplished manually or by using a tracing attachment and is available only for compensating any lack of rigidity in the machine.

The basic difference between power roll forming and conventional spinning is that in spinning, a blank considerably larger than that of the finished piece is used, while in power roll forming, owing to extrusion of the metal, the diameter of the original blank is exactly that of the finished piece, *Fig.* 2. In conventional spinning, parts are formed by pressing a blank against a rotating form block, using hand tools. This is essentially a manual art, requiring an operator who is a craftsman of considerable skill and experience. Even with experienced operators, parts lack uniformity. Since forming is completely a machine operation, uniform parts can be produced, and no "art" is required on the part of the operator.

Straight-walled tubes may be roll formed by either of two methods: forward rolling or back extrusion, *Fig.* 3. In the former method, a tubular blank is placed on a mandrel and chucked at one end. The rollers are engaged near the same end. The advance of the rollers is away from the chuck and the material to be formed moves ahead of the advancing rollers.

In back extrusion, the tubular blank is not chucked; one end is butted against a faceplate. The roller path is toward the faceplate and the material is extruded in the same direction.

Type of Part: Until four or five years ago, power roll forming was used principally for forming thin sections. Since that time, heavier sections

Abstracted from Paper 12, "Another Revolutionary Process—Power Roll Forming," to be presented at the 25th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

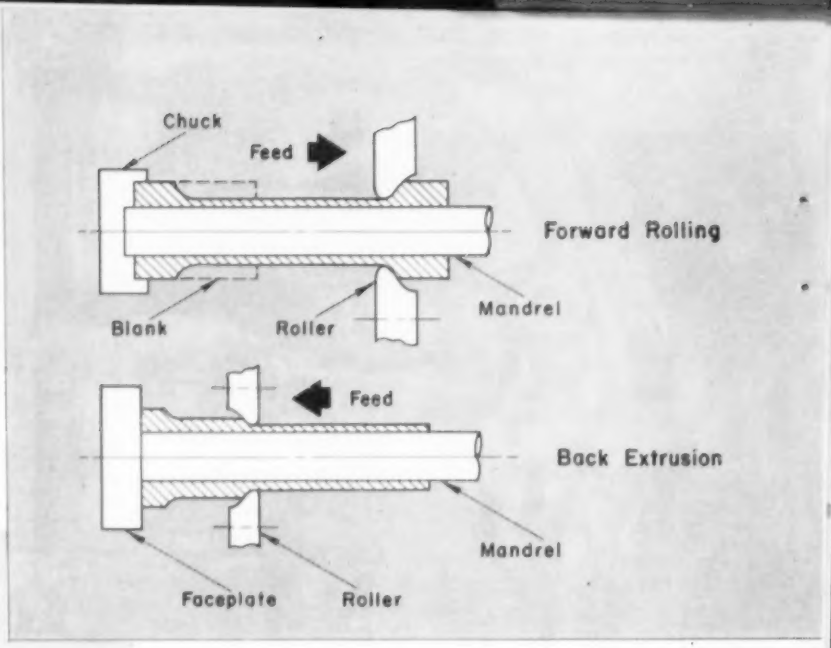
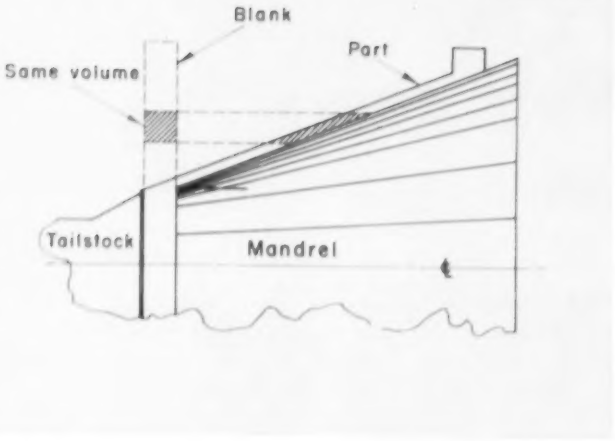


Fig. 2. (below) In power roll forming, the maximum diameter of the formed part remains the same as the diameter of the original blank.

Fig. 3. (right) Power roll forming can be applied to straight-walled tubes in either of two ways.



have been successfully formed. Power roll formed parts currently being manufactured include conical, hyperbolic and parabolic sections, and flanged cones, *Fig.* 4.

Simple shapes can be formed from flat plate. When more complex shapes are necessary, blanks may be prepared by machining, forging, drawing, welding or centrifugal casting. When the included angle of a cone is small, it may be necessary to use two mandrels, and to perform two separate roll forming operations.

Material: From the results of tests run on different high-alloy materials, it has been concluded that any segregation or inclusion which exists in the raw material will result in tearing during the forming operation. Because of differences in the formability of materials, a considerable amount of experiment is required in many cases before satisfactory power roll forming procedures are developed.

Physical properties of high-temperature alloys are improved because of cold working during power roll forming. The strengthening effect of power roll forming a high-heat resistant, high-strength alloy is indicated in TABLE 1. In instances where successive forming operations are used, intermediate annealing may be required.

Forces Involved in Forming: The force acting on the rollers during spinning can be resolved into three components:

1. Feed force. This force causes the desired deformation of the workpiece.
2. Radial force. This force maintains contact between the roller and the workpiece and provides high compressive stresses in the workpiece which allow high shear strains to take place without part fracture.
3. Rotational force. This is considerably smaller than the other two, and is required only to turn the rollers. The geometry of the roller is dictated by the shape of the workpiece and, generally, the contact surface is curved.

Machine Limitations: Currently, spindle horsepowers in the range of 100 to 125 hp (constant torque) at 50 to 350 rpm are used. Power requirements depend on material, included angle of the workpiece and feed rate. Spindle power is related to the thickness of the plate to be formed approximately as shown:

Thickness (inches)	Power (hp)
0.750	100
1.20	200
1.4	400
1.7	400

The wall thickness dimension of the roll formed part may be held to within ± 0.002 inch. In instances where a preformed blank is used, it is essential that wall thickness be closely controlled so

Fig. 4. Types of component parts being power roll formed today. The jet engine exhaust cone was made from a 0.125-inch flat disk of 321 stainless steel; the structural cone, from a 0.250-inch flat disk of titanium; and the hyperbolic section, from a 0.375-inch flat disk of 1020 carbon steel.

that the configuration of the preform will spin out to its proper position on the long axis of the mandrel, *Fig.* 5. Flanges, where desired, can be the same thickness as the original blank or thinner.

Lack of machine rigidity has been an acute problem in the power roll forming of some parts. The solution to the problem lies in setting the path of the rollers to compensate for the cumulative deflection of the rollers and the frame of the machine. Where the path of the rollers is not a straight line, a tracing attachment can give the required results.

The power roll forming process offers many advantages to the manufacturer of thin-walled parts with conical or cylindrical shapes. Such parts can be fabricated on a mass-production basis with higher quality and lower material costs than when competitive methods are used. It can be anticipated that many new applications will be found when the capabilities of the process are more generally known.

Table 1—Effect of Power Roll Forming on High-Heat Resistant, High-Strength Alloy Steel

	Tensile Strength (1000 psi)	Yield Strength* (1000 psi)	Elongation in 2 inches (percent)	Reduction in Area (percent)
Initially	140.0	80.0	15.0	18.0
After Forming	183.4	133.2	13.5	28.1

*Stress corresponding to a permanent set of 0.2 percent.

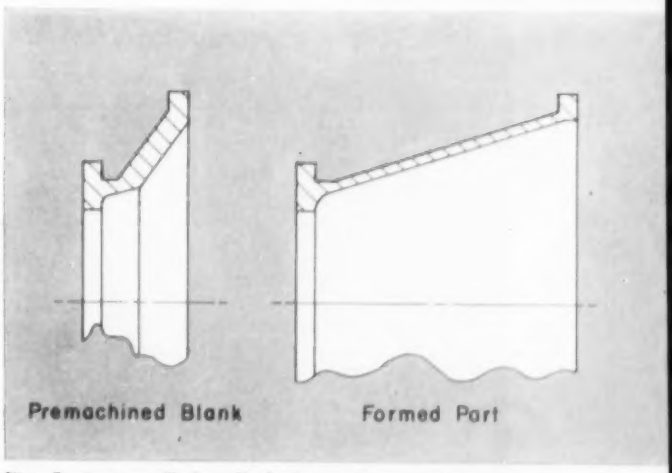


Fig. 5. A controlled wall thickness is essential for proper power roll forming so that over-all part dimensions will be to specifications.

designed for

PRODUCTION

Faster Fastening for Hex Nuts

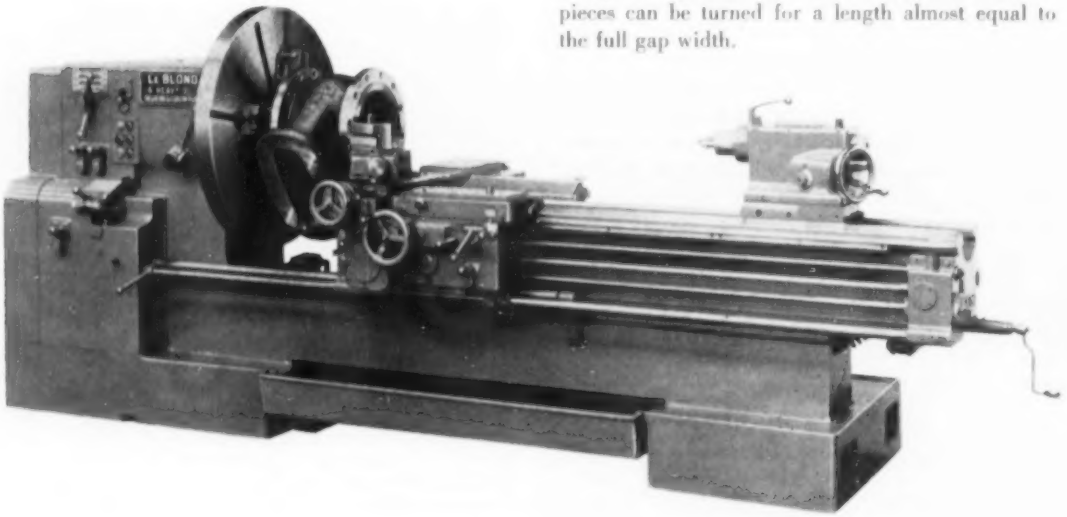
A fast-lead type of "impact" socket has been designed to meet the demand for automatic production fastening. No matter where the socket and nut initially contact, a broached opening allows the socket to fully engage the nut in no more than $\frac{1}{6}$ of a turn.

With these impact sockets, developed by The Apex Machine & Tool Co., single or multiple power tools can be operated continuously, thereby speeding the fastening operation. It is not necessary to start and stop the power tool for each operation or even to hesitate before the socket makes initial contact with the nut.

SLIDING BED LATHE
turns or faces oversize parts

With bed extended, this sliding-bed gap lathe results in twice the normal swing capacity and more than 50 percent greater distance between centers. With bed closed, this machine is used as a regular engine lathe. Ideal for handling the unpredictable extremes encountered in maintenance and job-shop work, this LeBlond lathe design is available in four designs.

The 16/38-inch lathe can be used to face 38-inch diameters in one cut; 45-inch diameters can be faced in two cuts. With an optional extension rest, workpieces 27½ inches in diameter can be turned in lengths to 13¼ inches. When the optional full-swing turning attachment is used, 45-inch-diameter pieces can be turned for a length almost equal to the full gap width.



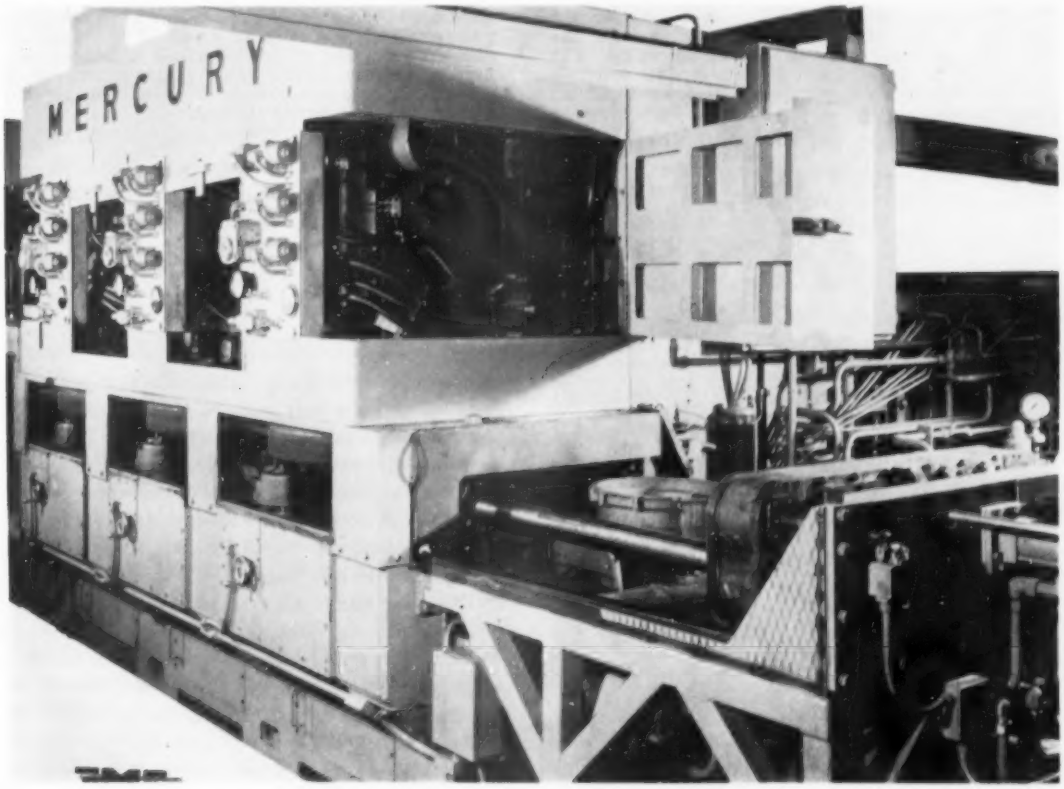
LARGE TRANSFER GRINDER

automatically sizes converter housings

One operator grinds both faces of 240 automotive torque converter housings per hour with this recently developed transfer grinder. About 0.100 inch of stock is removed from each of two mounting faces. The machine comprises three grinding stations for each surface with a flopover station between the grouped heads.

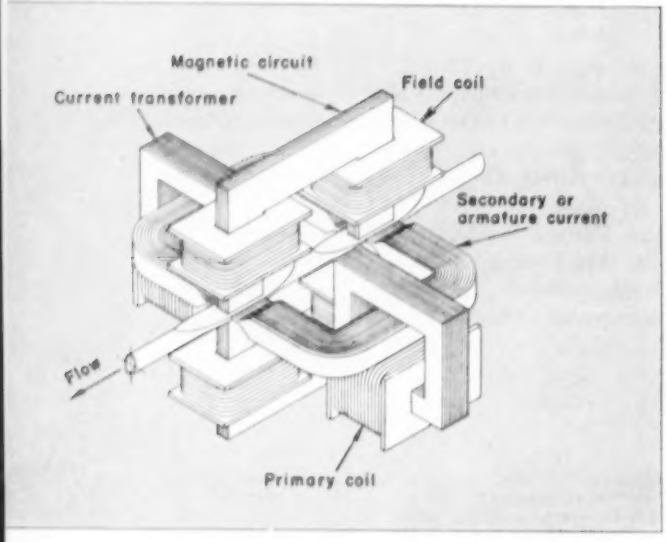
The machine, designed by Mercury Engineering Corp., is provided with automatic size control and automatic compensation for wheel wear. Dressing of the grinding wheels is also automatic, the dressers passing across the wheels after a predetermined number of housings have been ground.

LOADING STATION with converter housing, bell end upward, in position to be picked up by the transfer bars. The workpieces drop into nests at the six grinding stations. The nests are raised to definite stops, after the workpieces are positioned over the work spindles, so that uniform heights of the castings can be maintained. After a grinding step is completed, work spindles return to registered stopping positions so the nests always contact the castings in the same position.



DESIGNED FOR PRODUCTION

Pump Designed To Move Liquid Metals

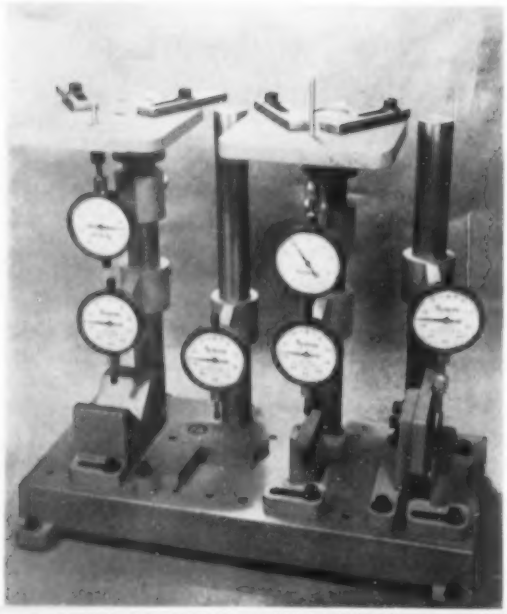


TWO-STAGE electromagnetic pump has two current transformers, connected additively, to supply the current in the secondary conductor through the pumping section walls to the liquid metal. The secondary conductors are brazed to the pumping section. This forms a continuous current path across one flattened portion of the pumping section and a return through the other flattened portion, with the secondary conductor completing the circuit between pumping sections. Flux is produced by four coils placed on the legs of two U-shaped laminated magnetic field cores. Flow rate of the pump can be adjusted by an autotransformer and the direction of flow can be reversed electrically.

An alternating-current conduction type electromagnetic pump can pump liquid metals if they are conductors of electricity, wet the pumping section and can be carried in metal pipe. This pump operates on the basic principle of the "left-hand rule." When current, perpendicular to a magnetic field, is passed through the liquid metal in the pumping section, a force is produced in the metal which causes motion at right angles to the current and the flux.

Pumps of this type, developed by Callery Chemical Co., will effectively pump those fluids having a lower electrical resistance than that of the pumping section wall. Such pumps work well on liquid sodium and sodium-potassium alloys. They may also be of use in pumping lead, mercury and magnesium.

Versatile Gage Unit checks multiple dimensions



A combination of adjustable units that can be set up to accurately gage an infinite variety of multiple dimensions, the Econo-Check can be used to inspect: diameters, lengths, external O-ring and snap-ring grooves, shoulders, counterbores, concentricities and locations of both internal and external forms. As many as ten dimensional checks can be made with one handling of the inspection unit.

For more complex parts, several of these units, developed by the Wm. L. Riggs Co., can be used together. Accuracy of the unit depends on the indicator gages used. Standard components include V-blocks, flat angles, parallels and 90-deg angles. An indicator-adaptor chuck is available so various lengths and shapes of contact points can be used.

buckling limits in contour forming

part two

By William W. Wood
Manufacturing Research Engineering Dept.
Chance Vought Aircraft, Inc.
Dallas, Texas

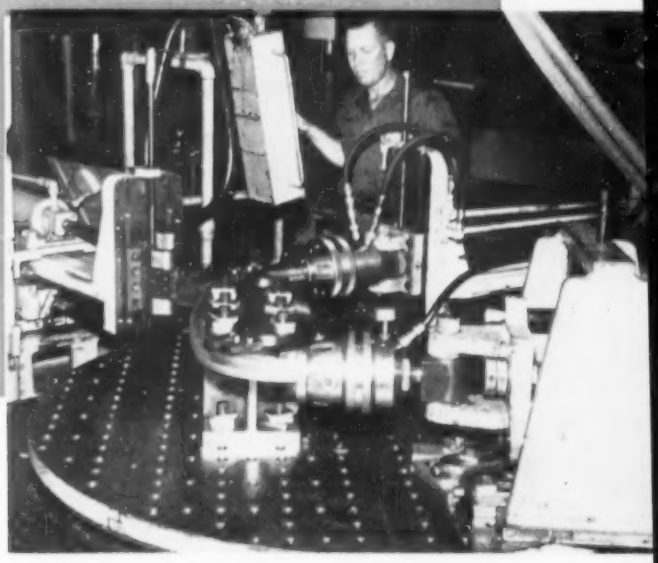


Fig. 1. Contour stretch press being used in formability experiments.

Plate buckling is the primary cause of failure when forming curved flanges. The author has developed formability limit curves which make it possible to predict whether a curved flange can be formed without buckling. Other forming limits are also covered.

THREE METHODS OF forming curved flanges in sheet metal parts are in general use in the aircraft industry: stretching or shrinking a part over a form block by means of rubber pressure and stretching a part around a form block in a contour stretch press. Irrespective of the forming method employed, plate buckling is the principal limitation to the formability of curved flanges. When a flange is subjected to shrinking or stretching it becomes unstable at a definite compressive load, owing to hoop compression in the case of shrink flanges or compression from residual stresses in the case of stretch flanges. Buckling may result.

Buckling is dependent on the geometric factors h, R and t, where h is the flange width, R is the contour radius and t is the thickness of the material. The mechanical properties E, S_{ty}, and S_{cr} also affect formability. E represents Young's modulus, S_{ty} tensile yield stress and S_{cr} critical compressive buckling stress.

It has been shown (THE TOOL ENGINEER, Feb. 1957) that S_{cr} is a definite function of h/R. Taking k, a numerical factor depending on flange length and width, and B, a size constant:

$$\log S_{cr} = \log kB - 2 \log \frac{h}{t}$$

which shows that the function $f(h/R)$ is a logarithmic function of the factors k, B and h/t. Plotting the equation on log-log graph paper, the -2 is a shape constant, showing that the equation is of the power 2, while the log kB determines the position of the curve.

Since the function $f(h/R)$ is unknown, the log kB cannot be derived. The log kB has, however, been evaluated empirically with $f(h/R)$ from data obtained during forming experiments, *Fig.* 1, with 17 different materials. The experimental parts all had simple flanges, with "heel-out" angles, *Fig.* 2,

Nomenclature

B = a size constant
E = Young's modulus
e = conventional strain
E/S_{cy} = shrink flange form index
E/S_{ty} = stretch flange form index
$1/S_{cy}$ = shrink flange form index
$1/S_{ty}$ = stretch flange form index
h = flange width
k = numerical factor depending on length and width of flange and edge conditions
L = flange length
R = contour radius
R_A = reduction in area
S_{cr} = critical compressive buckling stress
S_{cy} = compressive yield stress
S_{ty} = tensile yield stress
t = material thickness
ϵ = true natural strain
θ = angle of wrap

and were produced by rubber-forming at 1925 psi or by forming on a stretch press.

Shrink Flange Limits: The first step in developing formability limit curves from the data was to plot h/R against h/t on individual graphs for each material. *Fig.* 3. This data was then used to develop composite graphs showing the relative formability of all 17 materials.

In developing the composite graph for shrink flanges, *Fig.* 4, it was found that there was a definite dividing line between the regions of buckling and nonbuckling for 24S-O, 24S-T3 and 75S-O aluminum. The curves for each material were separated according to the formability index E/S_{cy}. This separation was on the ordinate, because the index and h/R determine the relative position of the curves. A single vertical line intersected the three curves very close to the formability index on the ordinate for each of the three materials. This vertical line is shown at $h/t = 19$ on the composite graph.

To show the elastic plate buckling curves for all 17 materials, the formability index times 10^4 for each material was plotted as a point on the vertical line. Drawing straight lines with a slope of -2 through the points produced the curves.

When h/t is small enough, depending on the material, yielding may be reached before buckling. Then the buckling is plastic, rather than elastic. Plastic buckling is dependent primarily on $1/S_{cy}$ and is represented by horizontal lines on the composite graph. The transition from elastic to plastic buckling is at a definite h/t for each material. Approximate transition points are $h/t = 20$ for aluminum, $h/t = 24$ for titanium and $h/t = 33$ for steel.

Experiments have shown that there is a gradual blending of the two curves, representing an elastoplastic region of buckling. This blending is over a greater $h/t - h/R$ range for the less formable materials. Soft materials have hardly any transition region, while harder materials have large regions of transition. Transition regions are shown as dotted lines on the composite graph.

It might be possible to eliminate the transition by using higher rubber pressures; however, it would probably be impossible to move the buckling curves to a more-favorable position by increasing the pressure.

In addition to plastic and electic buckling, there is a third limitation on the formability of rubber-formed shrink flanges. Insufficient rubber pressure causes the condition known as "minimum flange," in which the flange is not forced all the way to the form block. The condition is dependent upon h/R, h/t, S_{cy} and the machine rubber pressure.

This machine limitation was fairly well estab-

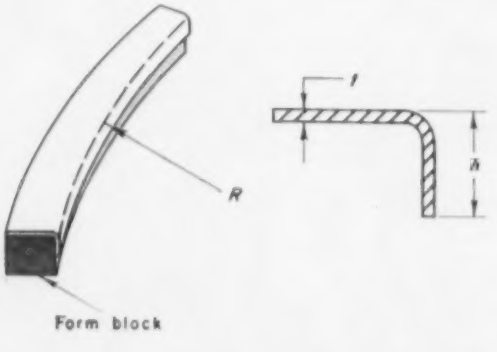


Fig. 2. Simple flange with heel-out angle. This is the type of flange used to develop buckling curves.

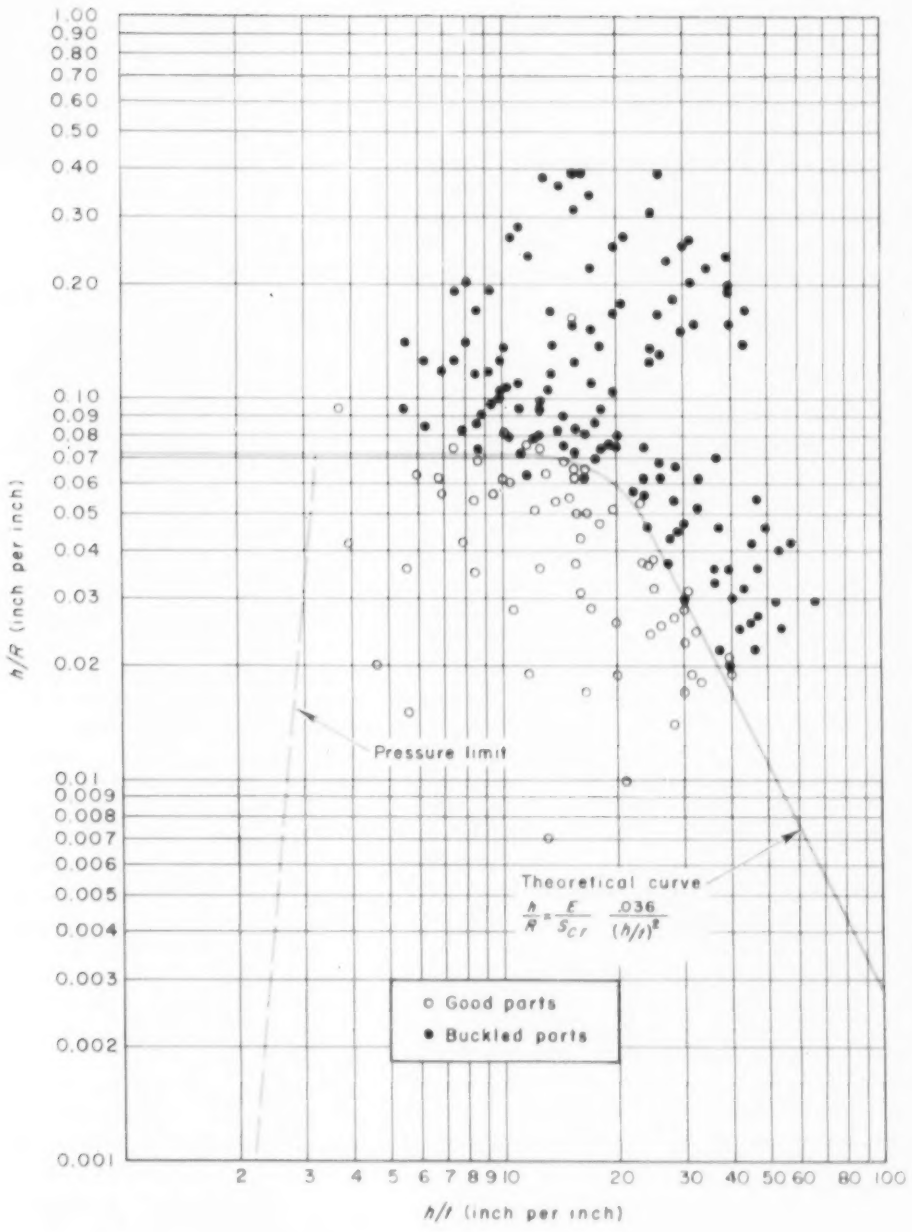


Fig. 3. Graph showing results of experimental shrink forming of 75S-O aluminum. There is a dividing line between buckled and good parts, as indicated by the theoretical formability curve.

lished for 302A, 61S-T6 and 75S-T6. The relative spacing of minimum flange lines on the composite graph was made by using the index $1/S_{cy}$. By denoting a point on the horizontal plastic buckling line for each of the three materials, a minimum flange index line with a slope of -2 was drawn on the composite graph.

Plotting known minimum flange values on an h/R versus h/t graph, it was shown that the pressure limit line has a slope of +4.7 from the index line. Minimum flange limits appear as dotted lines on the composite graph.

Maximum h/R and h/t values for the production of satisfactory parts are defined by three lines for each material on the composite graph. When h/R and h/t are plotted for a part made from any of the 17 materials, the resulting point must fall to the left of the elastic buckling line, beneath the plastic buckling line and to the right of the pressure limit line. If the point falls outside

of the area bounded by these lines, it can be predicted that the part will not be satisfactory. This prediction has been verified by numerous tests made subsequent to the establishment of the limits.

Limits for Rubber-Formed Stretch Flanges: As already pointed out, stretch flanges formed by rubber pressure fail principally because of plate buckling caused by residual stresses left in the flange. Long parts, ($L/h > 20$) buckle according to the equation:

$$f\left(\frac{h}{R}\right) = \frac{kB}{\left(\frac{h}{t}\right)^2}$$

This is the exact shape of the equation for shrink flanges; however, the size constant B will be different for stretch flanges.

Experimental tests were made with 75S-O, 24S-O, RC-70, RC-130 and 75S-T6. In the case of the latter three materials, there was a definite dividing line between buckling and nonbuckling. After averaging the position of these three lines an index line was positioned at $h/t = 40$, and the formability index E/S_{ty} was used to position all 17 materials on a composite graph, *Fig. 5*. Drawing straight lines with a slope of -2 through the position of each material on the index line gave the lower portion of the buckling curves.

When the value $R\theta/h$ is greater than 10, the value of the constant k is 0.456; θ being the angle of wrap. With diminishing ratios $R\theta/h$, the value of k increases rapidly. The result is that the critical stress S_{cr} and, consequently, h/R increase directly with k. Thus, the necessary h/R value to effect buckling will increase more rapidly than is indicated by the straight-line portion of the composite graph. The resulting curved lines finally become vertical lines. Any set of values for h/R and h/t that designates a point to the right of the curves will produce a buckled part, while those designating points to the left will produce a satisfactory part.

The inflection line shown on the composite graph is the intersection between the vertical lines and those sloping to the right. This line was found empirically to be perpendicular to the buckling lines having a slope of -2 and to intersect the $h/t = 10$ line at $h/R = 0.043$.

For large h/R values, parts may fail because of splitting of the flanges. The outermost fiber of the flange will elongate only a certain amount for a given material, and it will shear when this amount is exceeded. The elongation of the outer fiber is defined as the change in length divided by the original length:

$$\frac{L_1 - L_2}{L_2} = \frac{Rh\theta - R\theta}{R\theta} = \frac{h}{R}$$

This indicates that parts will split when a maximum h/R for a given material is exceeded. These limits are indicated by horizontal lines on the composite graph. The maximum strain will be the true natural strain for a material. Designating the original cross-sectional area of a tensile specimen as A_o, and the final area as A, the true natural strain ε is defined by:

$$\varepsilon = \log\ (A_o/A)$$

This equation may be rewritten according to the relation for the reduction in area of a tensile specimen:

$$R_A = \frac{A_o - A}{A_o} = 1 - \frac{A}{A_o} \text{ or } \frac{A_o}{A} = \frac{1}{1 - R_A}$$

Therefore:

$$\varepsilon = \log\left(\frac{1}{1 - R_A}\right)$$

The true natural strain of any material can be tabulated once R_A is known. The strain is usually three to four times as high as the conventional strain, e, as shown in the accompanying formability index table.

There are two factors to be considered when setting the maximum h/R limit for rubber-formed stretch flanges. First, the h/R will not give the exact true natural strain, except for a definite angle of wrap, because of the tendency of the outer fiber to shear. Usually, the angle θ has to be at least 130 deg to insure that $\varepsilon = h/R$. Since the horizontal lines on the composite graph showing the elongation limits indicate the true natural strain, it appears that the limits are on the safe side. There is a possibility that the notch sensitivity of materials could put the limits on the unsafe side. In practice, the two effects tend to cancel each other and the true natural strain is very close to the actual h/R.

For large angles of wrap, however, it is necessary to consider a notch sensitivity factor in order to establish the constant h/R line. RC-130 titanium is much more notch sensitive than the other materials tested and a notch sensitivity factor of 2 was adopted for this material. This decreased the elongation limit (h/R) from 0.51 to a value of 0.26.

Rubber-formed stretch flanges, like shrink flanges, cannot be formed below a minimum h/t value, because of insufficient rubber pressure. These lines are plotted as straight lines with a slope of $+4.7$ and are shown as dotted lines on the composite graph. The relative spacings are calculated according to the index $1/S_{ty}$ on the basis of known limits for RC-70 and RC-130 titanium.

Limits for Parts Formed in a Stretch Press: Flanges formed in a stretch press will buckle in the same manner and from the same type of re-

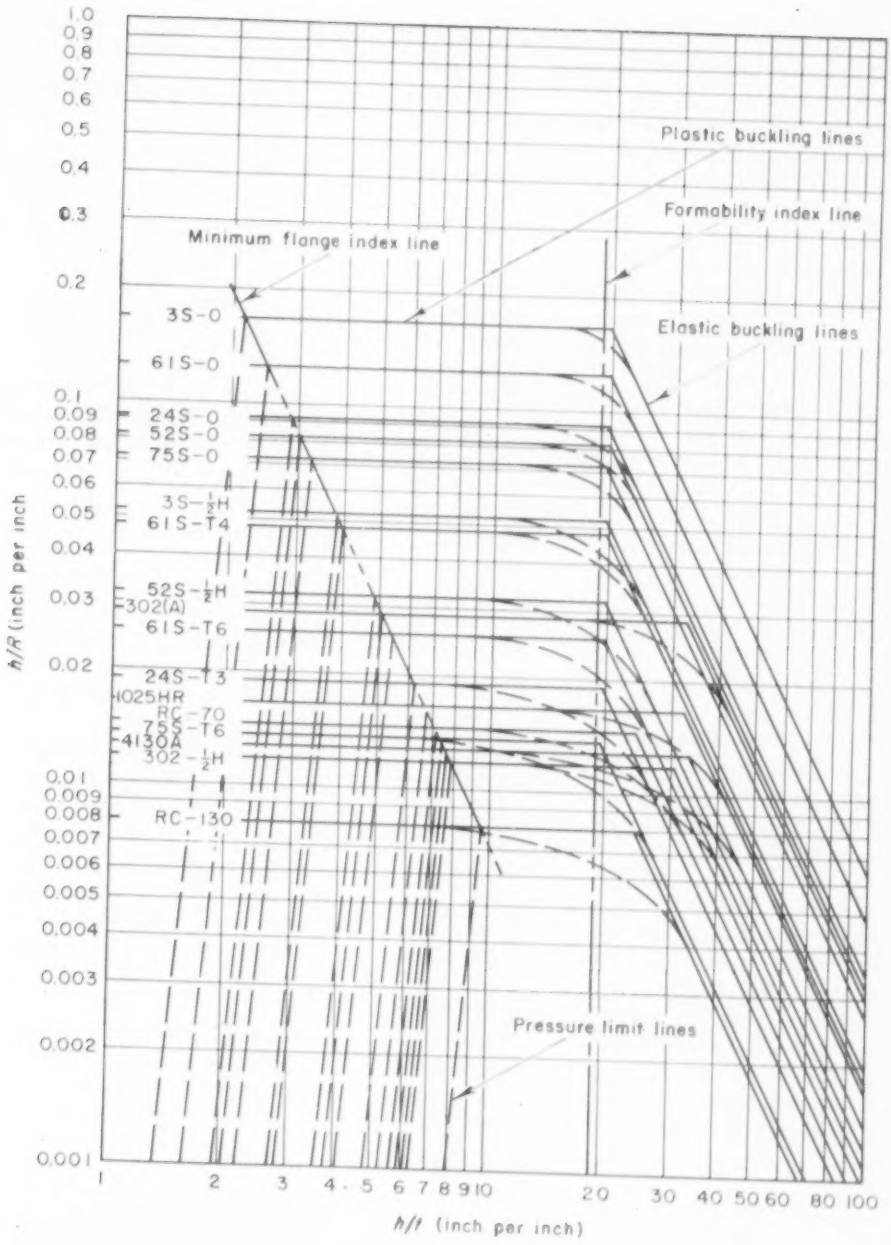


Fig. 4. Composite graph showing shrink flange limits.

sidual stresses as rubber-formed stretch flanges. The same buckling equation applies. However, the residual stresses are not nearly so large as in the rubber-formed parts; experiments have shown that B, and accordingly the function $f(h/R)$ are larger for flanges formed in a stretch press than for rubber-formed stretch flanges.

In order to develop formability limit curves, stretch forming tests were made for 24S-O, 24S-T3, RC-130A, RS-110 AT, RC-130 (V.A.), 302½H, 4130A, RC-70 and 75S-O. There was a definite dividing line between good and buckled parts in all cases.

In making up a composite graph, *Fig.* 6, an index line of $h/t = 70$ was used. As in the case of the other composite graphs, the formability index for each material was used to position all materials along the index line.

The curves again have a slope of −2, but break away from this slope at a definite h/R for each material. The inflection line shown on the graph

was found empirically to be perpendicular to the buckling curves and to intercept the $h/t = 10$ axis at $h/R = 0.035$. From this inflection point, the curves become vertical lines because of the increase in k with decreasing $R\theta/h$. The transition regions are shown as curves and are tangent along the lines shown on the graph. The transition region is large for hard-to-form materials and comparatively small for materials which are easy to form.

Beyond a definite h/R value, depending on the material, parts cannot be formed. A certain amount of the width of the flange will be in compression, depending on the position of the neutral axis. The area in compression buckles into sine waves. With further wrapping, these become compressed into wrinkles or square waves.

To remove the wrinkles, it is necessary to pull the part harder, thereby moving the neutral axis toward the concave edge of the flange and eliminating the compression stresses in the inner fibers. However, when the outer fibers are pulled beyond the true natural strain limit of the material, the part will break. The true natural strain is thus the only factor limiting the removal of wrinkles by stretching a part.

Because of the notch sensitivity of materials, it might appear desirable to use a notch sensitivity factor, rather than the true natural strain, as a limiting factor. Stress concentration caused by cracks had negligible effect during the experimental tests because all of the samples were of the heel-out angle type, with no free edge in tension. It is conceivable, however, that it would be necessary to establish a notch sensitivity factor for parts having a free edge in tension.

The upper h/R limits shown on the composite graph are, therefore, straight horizontal lines corresponding to the true natural strain of the material. These straight lines curve down as higher h/t values are reached. For large h/t values, depending on the material, the part of the flange under compression becomes less stable and buckling is evident at smaller h/R values. This effect is most noticeable on hard-to-form materials.

Fig. 5. (opposite page). Composite graph showing forming limits for rubber-formed stretch flanges.

Types of Flanges: There are two basic types of rubber-formed curved flanges: simple flanges, *Fig.* 2, and return flanges, *Fig.* 7. Simple flanges fail as indicated on the composite graphs. For return flanges, h/R and h/t become $(h_1 + 2h_2)/R$ and h_2/t. The probability of plate buckling is decreased, because h_2/t is generally less than 15, which is well below the forming limits for all materials. However, the machine limit may easily be exceeded because $(h_1+2h_2)/R$ is generally large.

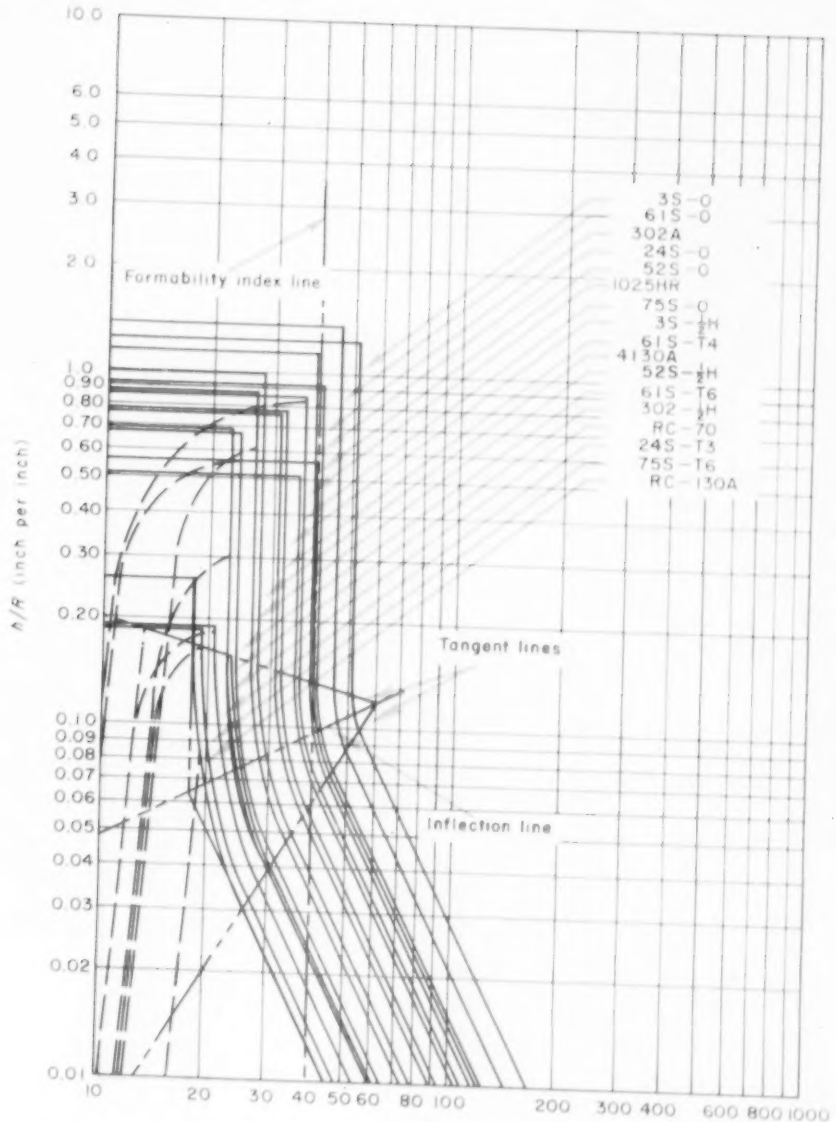
In practice, the true natural strain is rarely exceeded when forming simple flanges. It is quite frequently reached with return flanges, however, as evidenced by excessive splitting of such parts. Even when splitting does not occur, residual stresses may cause twist buckling.

Parts formed on a stretch press may be classified into three general types: the heel-out angle, the heel-in angle and the hat section. Only the first type has been covered in the experimental work described. It should be possible, however, to correlate the two other types of flanges with the heel-out angle type. Previous experiments have shown that both the heel-in angle and the hat have slightly less formability than the heel-out angle.

Effects of Higher Pressures: It is conceivable that some of the formability lines on the three composite graphs might be transferred to more favorable positions with the use of higher

formability indexes

Material Characteristics	Symbol	3S-0	24S-0	52S-0	61S-0	75S-0
Modulus of Elasticity (x 10^6)	E	10.5	10.5	10.5	10.5	10.5
Tensile yield stress (x 10^3)	S_{ty}	6	11	12	8	15
Compressive yield stress (x 10^3)	S_{cy}	6	11	12	8	14
Conventional strain (percent)	e	40	22	30	30	16
Reduction in area (percent)	R_A	71	43	68	75	40
True natural strain (percent)	ϵ	124	56	114	138	51
Stretch flange form index (x 10^6)	$E/_{ty}$	17.5	9.55	8.75	13.1	7.00
Shrink flange form index (x 10^3)	E/S_{cy}	17.5	9.55	8.75	13.1	7.50
Shrink flange form index (x 10^{-3})	$1/S_{cy}$	16.7	9.10	8.33	12.5	7.15
Stretch flange form index	$1/S_{ty}$	16.7	9.10	8.33	12.5	6.66



Material											
3S-½H	24S-T3	52S-½H	61S-T4	61S-T6	75S-T6	RC-70	RC-130	302(A)	302(½H)	4130(A)	1025(H.R.)
10.5	10.5	10.5	10.5	10.5	10.5	16	16	29	26	29	29
19	52	31	21	40	72	70	125	30	110	75	39
19	52	31	21	39	75	70	125	35	85	75	60
16	17	14	25	17	11	20	17	40	20	22	38
54	17	59	54	49	17	50	40	60	.....	63	58
78	19	89	78	67	19	69	51	92	.....	99	87
5.50	1.84	3.40	5.00	2.62	1.46	2.29	1.28	9.66	2.36	3.87	7.44
5.50	2.02	3.40	5.00	2.70	1.40	2.29	1.28	8.30	3.06	3.87	4.85
5.25	1.92	3.22	4.76	2.57	1.33	1.43	0.80	2.86	1.18	1.33	1.67
5.25	1.75	3.22	4.76	2.50	1.39	1.43	0.80	3.33	0.91	1.33	9.56

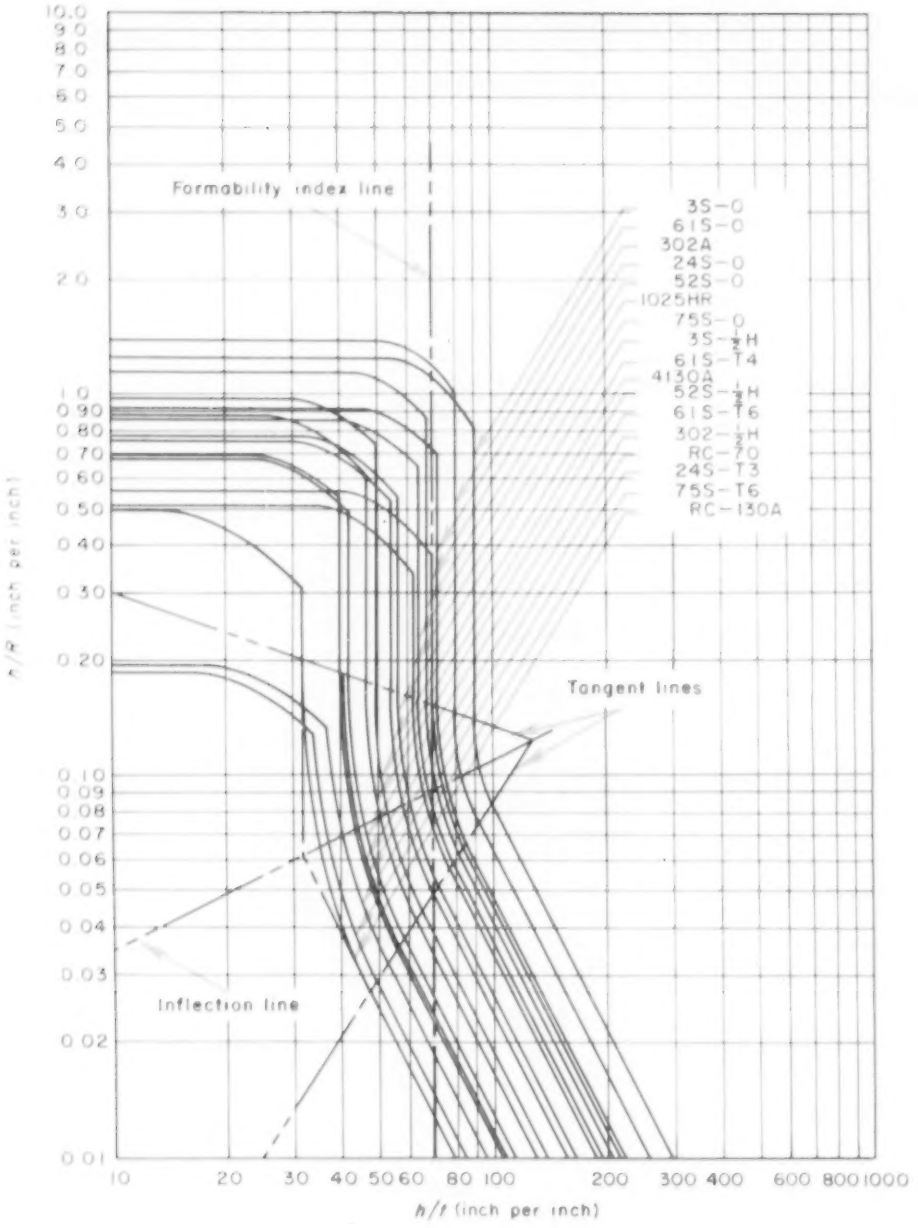


Fig. 6. Composite graph showing forming limits for stretch-press-formed stretch flanges.

pressures. This possibility applies only to machine limitations and not to buckling or elongation curves. In the case of shrink flanges, for instance, the transition region between elastic and plastic buckling might be made smaller. Also, the minimum flange limits for rubber-formed stretch and shrink flanges might be moved somewhat to the left on the graphs.

Using the Curves: The curves on the composite graphs define the formability limits for the 17 materials listed. The limits of any material may be derived in the same manner by using the pertinent formability index. Equations have been derived from the composite graphs to express the formability of materials in mathematical form; however, these equations are primarily of academic interest. The graphs are more convenient for finding the solutions to practical formability problems.

It should be pointed out that the curves can only be as accurate as the available data on mechani-

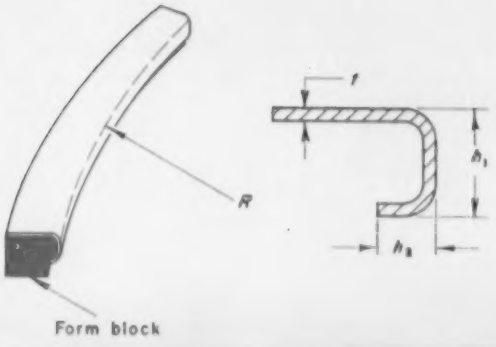


Fig. 7. A return flange. Data in the formability curves for simple flanges can be correlated to the forming of this type of flange.

cal properties of materials. These properties, especially the yield strength, vary between different lots of the same material. Consequently, in actual practice there may be slight variations in the formability of different lots of material.

By using the curves, it is possible to predict many of the forming characteristics of various materials. The shrink flange graph, for instance, shows why it is virtually impossible to shrink RC-130A titanium. Only when the h/R is below 0.008 can this be accomplished. To shrink an 0.4-inch flange, a 50-inch contour radius would be necessary. A further restriction is that the h/t cannot be less than 10 or greater than 25.

The shrink flange graph also indicates why materials such as 302-½H, 4130A, 75S-T6, RC-70, 1025 H.R. and 24S-T3 are impossible to shrink unless the h/R is below 0.02 and h/t is between 8 and 20. The relative ease of shrinking most of the S-O aluminum materials can also be seen from the graph. It is evident that, for a given small h/R value, wrinkling will be a greater problem with titanium than with steel and a greater problem with steel than with aluminum. This is because of the difference in Young's modulus for the materials.

The composite graph for rubber-formed stretch flanges clarifies many of the problems associated with this type of forming. It shows, for instance, that RC-130A titanium can be formed only within the limits of a small triangle bounded by lines joining the points $h/t = 16$, $h/t = 45$ and $h/R = 0.08$. This area could be made larger by using higher rubber pressures, which would move the minimum flange line to the left.

Approximately 90 percent of all rubber-formed stretch flanges fall in the region between $h/R = 0.02$ and $h/R = 0.20$. Since the elongation limits are above $h/R = 0.20$, splitting of flanges is seldom a problem with simple flanges. Splitting does occur, however, on return flanges.

Formability curves for parts made on a stretch press have the same shape as those for rubber-formed stretch flanges. The buckling limits are much higher for parts made on a stretch press, as shown by the formability index lines for each. The index line for stretch press-formed parts is $h/t = 70$, while for rubber-formed stretch flanges it is $h/t = 40$. Thus a given stretch flange may be formable on a stretch press, but may not be formable by rubber-forming methods.

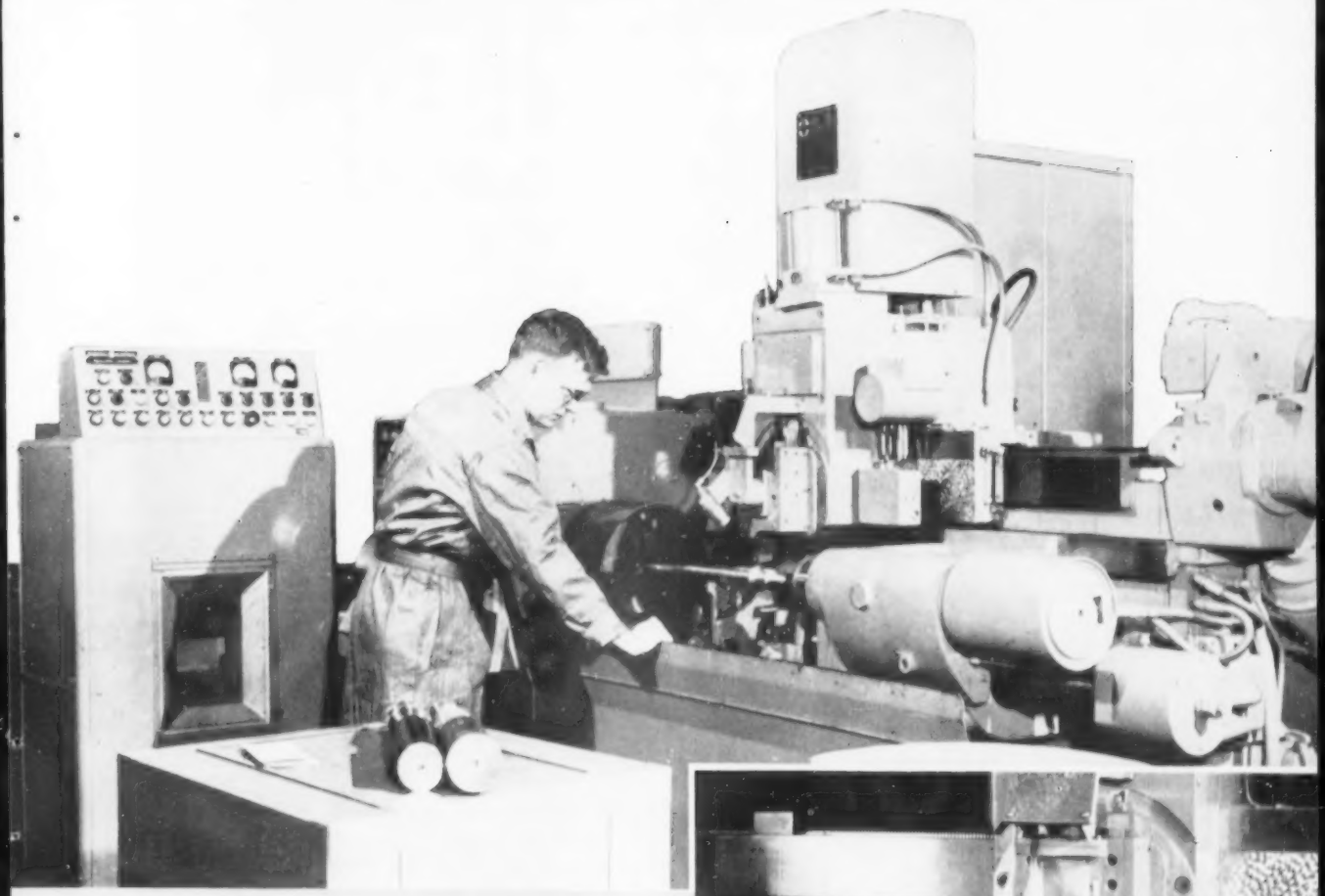
'Engineer Relief' through Student Help

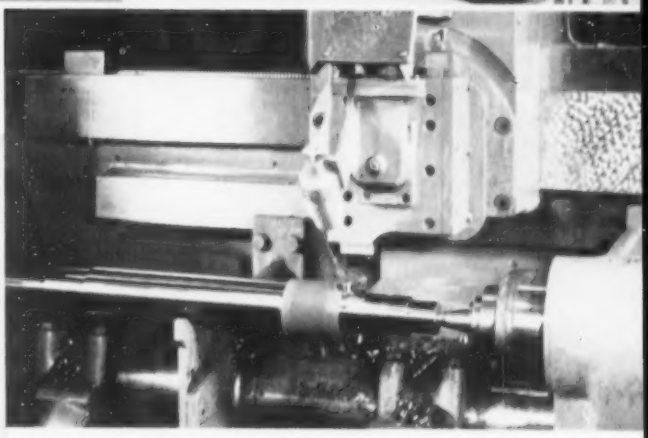
Industry's attack on its professional man-power problem might be guided by a lead from the Research Div. of New York University's College of Engineering. Dr. Harold K. Work, director of the Division, reported in its *Engineering Research Review* the experience of hiring a 15-year-old high school junior who had a straight-A average in mathematics and science courses. Routine duties on research projects, including some sponsored by the Air Force and the Army Office of Ordnance Research, were assigned to the youngster. Such work as preparing specimens, assisting in wave propagation experiments and static stress tests, and reducing data from oscilloscope photographic records was successfully carried on by the part-time student assistant, when it otherwise would have taken the time of a full-time research engineer.

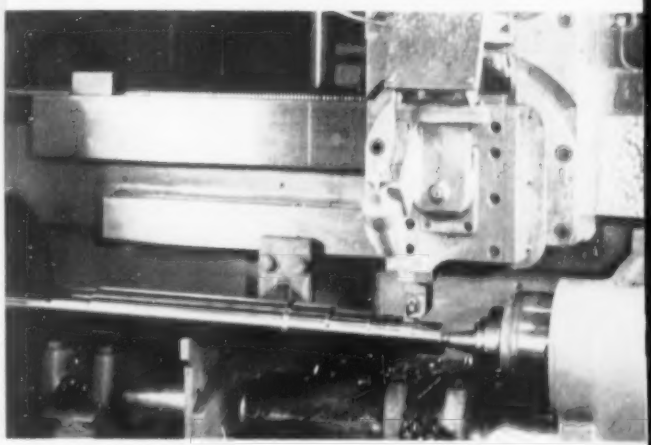
This individual experience, while serving in itself only as a minor solution to the man-power problem, has convinced Dr. Work that employment of high school students of ability could stop much of the drain on the professional level and might even, as he points out, convince the youngster that he should choose a career in engineering or science.

JOB-LOT AUTOMATION is exemplified by numerically controlled lathe. Punched card control of Sunstrand production lathe is found to give as much as 80 percent reduction in setup time. Operator places punched cards in numerical positioning control station to set up the job. Production cycles for the machine are programmed into the cards from process drawings. The control system was developed by GE.

TOOLS at work



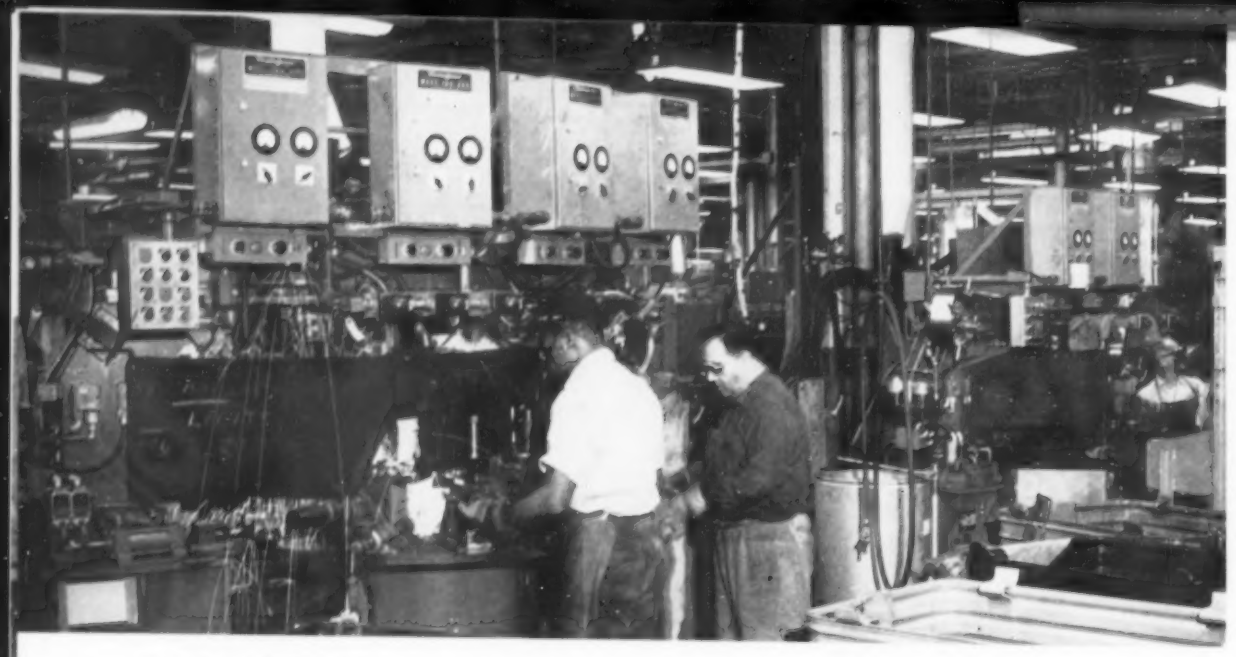


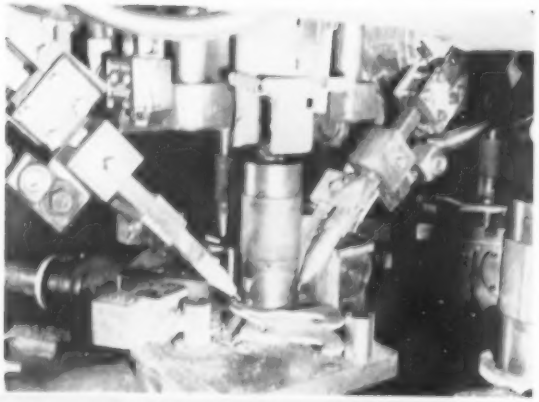


MULTICYCLE LATHE is performing a typical step-turning operation at varying spindle speeds and feeds, all of which are predetermined by program engineers, at optimum for each step.

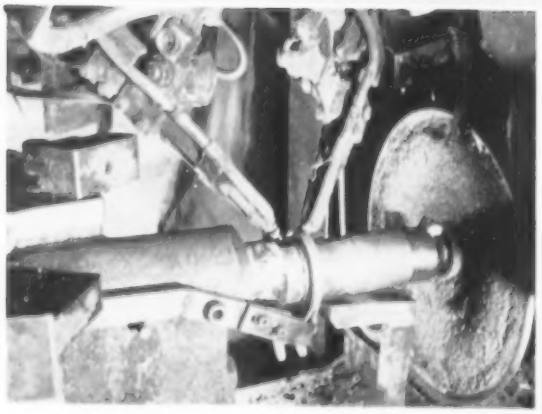
HEAVY ROUGHING CUT (center) is being completed on last step of workpiece. While actual operation is in progress, operator can attend another machine. As many as five such lathes are handled by one man, depending on the cutting cycles of the workpieces.

FINISHING CUT (right) is taken in last phase of production cycle on punched card controlled lathe, still without intervention of operator. Entire range of 280-2025 rpm spindle speed and longitudinal feeds from 7½ to 29½ ipm can be employed as preselected by the process engineer.



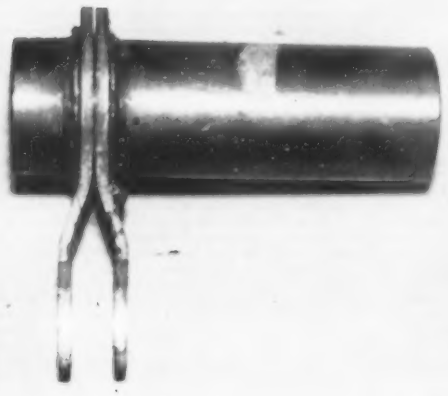


TOOLS at work



WELDING AUTOMATION produces 200 automotive anchor plate assemblies per hour in circular index machine at Chrysler's Highland Park plant, using CO_2 shielded-arc method. The index table of the Expert machine consists of 8 stations, each with a two-stage fixture.

The two pieces of the assembly are loaded into the first stage in station one. This fixture accurately positions and holds the parts in alignment with the bushing in vertical position. The parts index through a second loading station and open station. In the next station, a T-clamp rotates around the hooked end of the plate and clamps it for two tack welds. After indexing through open stations five and six, the part is passed through station seven back to load station where it is placed in horizontal position. When it reaches station seven again it is given a continuous 360-deg weld on each side of the part while held by an air-powered quill. Completed assemblies are stripped from the machine by a cam-activated ejector plate.

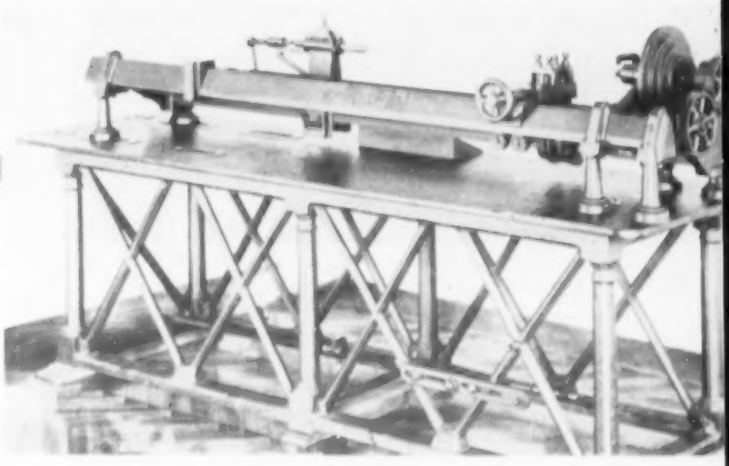


cavalcade of tools

...and the men who shaped the present

By Robert B. Douglas*

President
Specialloid Ltd.,
St. Eustache, Quebec, Can.



Joseph Whitworth lathe, built in the shops of Henry Maudslay in 1828, included a lead-screw for automatically traversing the tool.

Tool engineering would be unknown had it not been for the pioneers in machines and methods. Some of the men responsible for tool engineering are here singled out in terms of the advances they achieved.

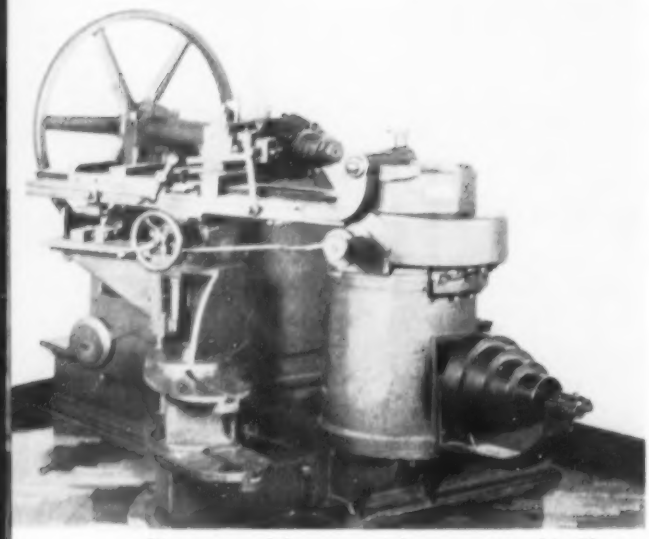
CURRENT INTEREST in automation has brought tools and the tool engineering function under critical, public review during the last two years. While both the word "automation" and the intensive interest in it are new, the concept is not. Present implementation of automatic production programs is the culmination of a long, and sometimes arduous, history of men and machines. Modern progress, amazing and rapid as it is, is no more amazing than the early steps taken by tool engineering pioneers. Measured in lifetimes, their advances were slow but they had only scanty knowledge and inadequate mechanisms on which to base their developments.

Strictly speaking, automation may be defined as the automatic transfer of work materials from one production process to another without losing control of the part between operations. This has been stretched to mean, in its ultimate, the automatic working of the entire production process without human intervention. In the latter sense, it seems to have had a somewhat disquieting effect on the public. That developments in tooling are coming to such rapid fruition should not be disturbing but should rather cause wonder that they have been so long in coming. These production advances herald fulfillment of the tool engineer's forty-century dream of the final liberation of mankind from drudgery.

The first tool engineer whose name was to stand out in history, after Tubalcain, the father of all tool engineers, was Daedalus of Crete. Sculptor, architect, lover, murderer and early tool engineer, he is credited with the invention of the axe, the saw and the drill. It was this same Daedalus who, when imprisoned in Crete with his son Icarus, invented wings of wax and feathers and escaped to continue his work in Sicily.

Daedalus' own nephew Talus—incidentally these two were hated rivals—brought mankind along the next step toward the modern industrial system with the invention of the potters' wheel. This mechanism is the grandfather of all machine tools and the

*Life member ASTE Montreal chapter



First successful commercial gear cutter, this Gleason bevel gear cutter was built in 1876.

blood site of the modern engine lathe.

This wheel was a simple vertical headstock with a rotary spindle and demonstrated, in simple form, the generating process. An operator could generate a form through the plastic working of a material held on the faceplate by friction and gravity. The form tool was the operator's hand and he acted as his own power source.

The Greeks developed a sounder system of mechanical motions and Egyptians applied hydraulics to perform work in other fields. Yet, with the exception of a brief, local spurt caused by the development of conveyorized assembly and the use of interchangeable parts by Venetian shipbuilders in the fourteenth century, production techniques and equipment didn't progress much until the sixteenth century. Except in soft substances such as wood and clay, nearly everything was formed by casting or hand-forging processes developed by the Phoenicians.

Other than crude hand tools and primitive wooden turning machines, there were no basic developments in the arts of cutting and forming until 1578 when Jacques Besson of Lyons, France, developed a wooden lathe having a horizontal bed. The tool could be traversed along a guide screw, which was turned simultaneously with the work by means of a system of pulleys and cords. Besson's machine was capable of cutting screws of any coarse pitch by the use of pulleys of different diameters.

Developments in any one place have seldom come singly in the progress toward modern production equipment. At this same period in France, Le Forq invented the planer; Condamine, de la Hire and Plumier describe the cutting of irregular figures on a lathe by the use of tracers moved over the faces of sculptures.

At the beginning of the eighteenth century, steam power was in the early stages of development. The power source for most machines, however, was still man himself. Although developments in machine tools had been largely confined to the lathe, metal could be turned, screws could be cut and some forms could be generated. Tools were still simple and manipulated by hand, and man was still acting as his own control system.

Although the steam engine represented a new source of power, its primary importance to machine tools was not as a power source. Instead, it had a profound effect on machine tool design, because of the manufacturing problems it presented. For the first time, industry was faced with the necessity of fitting metal parts together in an operating mechanism.

Watt's greatest problem was accurate machining. His finished cylinders were out of round, out of parallel and tapered, and his engine would operate for short periods only. To redesign the boring process, he collaborated with Wilkinson, in whose shop the engines were built. Modern boring machines are similar in principle to the first horizontal boring machine that resulted from this collaboration.

The shops of Midland, England, were the scene of the next concentrated activity. General Sir Samuel Bentham, the man who later invented the planing machine for wood, invented a slide rest for application to the lathe. Henry Maudslay improved the slide rest by his invention of the compound rest, building upon the screw-cutting improvements of Besson. He also designed and constructed the first gear-cutting machine for removing metal to form spaces between the teeth.

In writing of Henry Maudslay's invention of the compound rest, an Englishman in 1855 remarked, "Simple and outwardly unimportant as this appendage to lathes may appear, it is not, we believe, averring too much to state that its influence in improving and extending the use of machinery has been as great as that produced by Watt's improvements to the steam engine itself. Its introduction went at once to perfect all machinery, to cheapen it, and to stimulate invention and improvement."

During the 1780's, Oliver Evans, the first designer and builder of a motor car in America and one of the earliest American tool engineers, introduced the conveyor system to New England industry, principally in milling. The reason that it did not then catch hold and develop as it did almost 125 years later under the aegis of that other later automobile enthusiast and conveyor specialist, Henry Ford, was that other phases of tool engi-

neering technology were not ready for it. Industry was some several hundred other inventions and developments away from being able to use conveyors economically.

Conveyorized assembly systems are practical only when they are fed by machines that can operate at a rate that makes the conveyor worth the space it takes and the investment it represents. In their turn, machines that operate at such speeds are useless unless the cutting tools mounted on them are able to take the types of cuts that will make their employment worth while.

The metal-cutting milling machine represented the next major advance, with both Maudslay and Eli Whitney vying for the credit of its invention. Use of these machines was limited, however, because of their expense and the cumbersome cutters required. Joseph Bramah, in whose shop Henry Maudslay had received his mechanical education, invented the hydrostatic press in 1802 and shortly after developed the metal planer from Le Forq's earlier conception.

In 1819, Thomas Blanchard of Philadelphia developed the first really successful duplicating lathe. Used largely for turning gun stocks and shoe lasts, this machine revolutionized these branches of woodworking.

Richard Nasmyth, who was a workman in Maudslay's shop, invented the steam drop hammer when he was called on to forge a large propeller shaft in 1830. Designs of such hammers have changed little since that time. Nasmyth also invented the shaper, which for a long time was known as "Nasmyth's Iron Arm." The vertical drill came into being at about this time as an adaptation of the horizontal bar lathe.

The steam engine, as a prime mover to supply power to machine tools, still had not been applied to any great extent. In 1825, Maudlay's shop, which was one of the largest and most advanced in England, still relied largely on men to turn the wheels. During this same year, at the Annual Exhibition in Philadelphia, the firm of Mason and Tyler exhibited the most advanced lathe of the time in America. It was similar to a modern bench lathe for woodworking but was operated by a foot treadle. Only in the case of large lathes and boring mills used in the manufacture of steam-engine cylinders and marine paddle shafts was the steam engine coupled to machine tools as a source of power.

In the period following 1850, existing wooden machines and mechanisms were duplicated in metal. Developments and advances were few, with only minor changes being made during the building of tools having metal structures.

Water power became the dominant power source in small industry and steam was applied in large industry. The trend toward steam as a centralized power source was coincident with the trend away from the small craftsman's shop. Since steam was economical only in large units which, of necessity, had to run continuously, the whole pace of industry speeded up and the quest for refinements in machine tool design and manufacturing process was intensified.

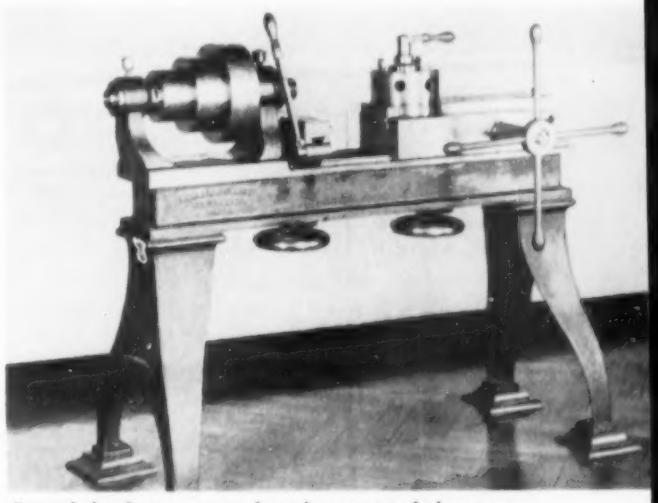
Emphasis, after 1850, shifted from basic invention in the machine tool field to developments in the field of tools. It was this shift in emphasis that has since paced the development of power application and machine tool design.

In 1860, R. Mushet, working in France, made

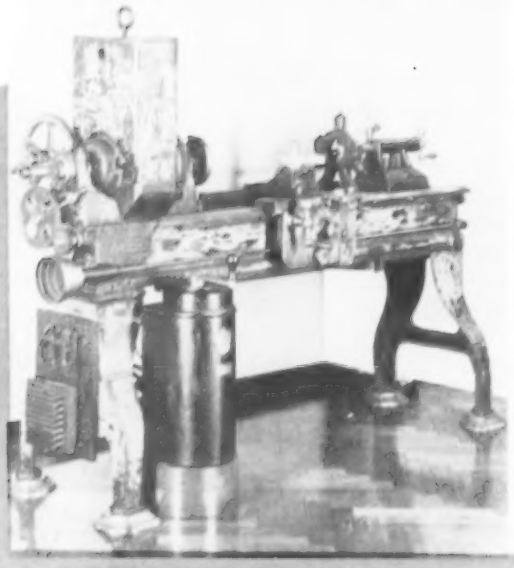
Elements of Production Equipment

- **Power Source** (motor)
- **Transmitting Mechanism** (machine tool)
- **Tools**
- **Control System**

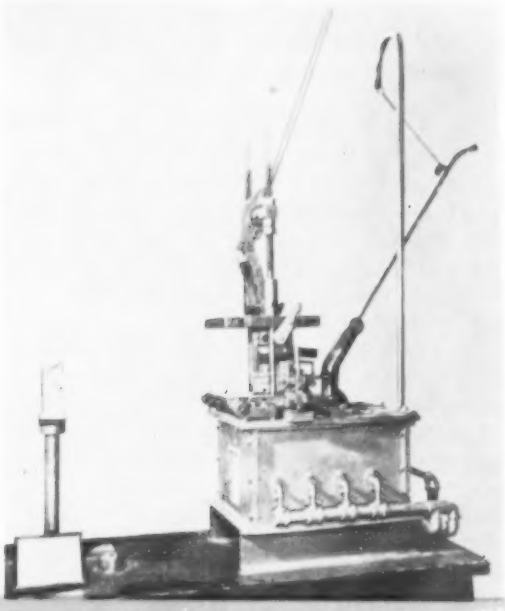
Tools alter the form of workpiece materials. Machine tools supply appropriate motions to the tools, workpieces or both. In the earliest stages of production, man was all of these production elements. Developments by tool engineers have caused the functions represented by these elements to be done mechanically and electrically.



One of the forerunners of modern turret lathes was this hand turret built by Warner & Swasey in 1881.



The Lodge & Davis Machine Tool Co., Cincinnati later acquired by Allis Chalmers, developed this electric lathe in 1892. The motor rotor was integral with the spindle.



First practical die-casting machine was developed by H. H. Doehler in about 1905. The machine was manually operated, gas heated and could only produce small castings.

important contributions to metal-cutting technology through his researches on the effect of additions of manganese and tungsten to form harder and more wear-resistant tool steels. Tools made of these new steels made faster, heavier cuts possible, which, in turn, required heavier, more accurate machine tools and increased the requirements for power.

Manufacturing development could have gone little further without the stimulation provided by the invention in 1864 of the emery wheel. This marked the beginning of a new era in manufacturing. The emery wheel made it possible to fashion tools of materials that were too hard to be ground by natural stones. This opened up a whole new field of steel cutting tools and paced the development of metal-cutting techniques. Also, since parts of machine tools could be accurately ground, piece parts could be produced with greater accuracy. The emery wheel was also applied as a cutting tool in its own right to improve production accuracy, speed and finishes.

The emery wheel, as originally developed, had limitations that were later overcome by discoveries in the early 1890's of silicon carbide and aluminum oxide by Acheson and Jacobs, respectively. During this period, Whitelaw developed the first cylindrical grinder, essentially as it is known today. The work and wheel rotated at different speeds in opposite directions and the grinding wheel was traversed across the work to remove the desired material.

Following these developments, industry was in a position to take advantage of the discovery of high-speed steel by Taylor and White of Bethlehem, Pa. Hard, high-melting-point, wear-resisting cutting tools were then available. The high cost of these tool steels prevented their widespread acceptance until the pressures and high-production volumes of World War I required their use. They did not fully come into their own until the thirties, just before the beginning of World War II, by which time they had practically rendered carbon steels obsolete as tool materials.

In 1939, high-speed steel was itself being superseded by an even harder tool material, tungsten carbide, developed by Krupp in Germany during World War I. With cemented carbides and machines capable of using such tools, production engineers at last had a combination that could be used for mass production, as the production record of World War II attests.

Paralleling the developments of tool materials, there was a significant change in the field of power sources. Water power, as used by much of industry in the late nineteenth and early twentieth centuries was grossly inefficient due to its sharp rises and falls with the seasons, which, unhappily, seldom meshed with production requirements. Steam, however, was an expensive source of power, both as to original cost and that of operation. Steam plants could not be readily shut down and restarted,

and they did not lend themselves to variable expansion and contraction of output in accordance with the shop load.

With the invention of the electric motor during the latter half of the nineteenth century and its development in the first part of the twentieth century, industry was finally freed from one of its most burdensome problems. At first, a big electric motor was merely substituted as a central power source for the steam plant or the water wheel it replaced. Machine tools remained essentially the same, with most of its functions as a transmitting mechanism remaining outside the machine itself in the form of complex and inflexible systems of line shafting, belts and pulleys.

Only during the 1930's did a movement become apparent to take advantage of the divisibility of electricity by coupling small electric motors directly to individual machine tools. The essential feature of the new type of power was that it could be infinitely divided, but it took about 50 years for the metalworking industry fully to appreciate this fact and take advantage of it.

Herein lies a danger already apparent in the approach to the use of nuclear energy. The lessons of the past should not be forgotten. As the essential value of electricity was in its infinite divisibility, so too has nuclear energy unique characteristics. Industry should not spend the next 50 years needlessly trying to substitute this new fuel for the fossil fuels just as a means of boiling water to make steam to generate electricity.

It is impossible to look far beyond the rim of the present, but three general trends, or perhaps tools, can be recognized. Tool engineers will have to learn to work with these tools if they are again to remake the concepts of production methods. These tools, which might be called the tools of destiny, are: Communications and Control, fathered by Norbert Weiner in the late 1930's; Electronics and Nucleonics.

Harnessing together of these first two tools will eliminate man as a control system, just as man was eliminated from the mechanical cycle successively as the tool, transmitting mechanism and power source. This cannot transpire too quickly. Man is far too slow and uncertain as a control system to long intervene in the new high-speed manufacturing processes. Although the special characteristics of nuclear energy are not yet fully known, let alone applied, it is safe to say that man could not in himself act as an efficient control system for equipment powered by nuclear energy.

Each time that man has been able to eliminate himself from a portion of the manufacturing cycle, his dignity and physical well-being have been advanced. Destiny's tools are available today and those who are prepared to use them can fulfill the dream of production without drudgery.

Acknowledgements

All of the machines pictured, with the exception of the die-casting machine, are owned and displayed by The Henry Ford Museum, Dearborn, Mich. The die-casting machine is on display at the Smithsonian Institution in Washington, D.C. The photograph is through the courtesy of Doehler-Jarvis Div., National Lead Co.

A TOOL ENGINEERS CALENDAR

(every month)

This Tool Engineer's Calendar may be a solution to many problems. Here is what it can do for you.

1. Work can be ordered on the 7th and delivered on the 3rd.
2. There are two Fridays in every week so that everyone can have his job on Friday.
3. There are seven extra days at the end of the month for those end-of-the-month rushes.
4. There are no "first-of-the-month" due dates. The "tenth" and "twenty-fifth" have also been omitted.
5. There are neither bothersome nonproductive Saturdays and Sundays nor time and a half or double time to pay.
6. There's a new day each week called Negotiation day for planning projects or revising schedules.

NEG	FRI	FRI	THU	WED	TUE	MON
8	7	6	5	4	3	2
16	15	14	13	12	11	9
23	22	21	20	19	18	17
31	30	29	28	27	26	24
38	37	36	35	34	33	32

how to mill with CARBIDES on older machines

By Horace Frommelt
Frommelt P M Cutters, Inc.
Philadelphia, Pa.

Can carbide cutting tools be successfully used on older machines? The author's experience indicates that they can if machines are in good condition and machine limitations are understood.

CARBIDE CUTTING TOOLS have been in use in industry for many years. During this period, emphasis has been placed on replacing existing machines with new machines which are designed for extremely high speeds and feeds, and can therefore use the productive potential of carbides to the maximum extent.

However, even on older machines, carbides can significantly increase machining rates if used intelligently. Milling rates, for instance, can be more than doubled on older machines, by using carbide cutters in place of high-speed steel cutters. The doubled cutting rate will still not be as high as can be attained when using a modern, high-horsepower machine, but the increased production is often desirable.

Three factors are all-important when planning to use carbide tools on older machines:

1. The machine should be put into the best possible operating condition and kept that way through an adequate maintenance program.
2. A person who is familiar with carbides should be placed in charge of the program.
3. This individual should select the jobs which are best adapted to carbide machining, and develop specific operating instructions for doing the job. He should have authority to see that these instructions are carried out to the letter.

Putting the Machine in Condition: A good starting point when preparing a machine to use carbides is to determine the horsepower rating on the spindle drive motor. Horsepower ratings are not too important when machining with high-speed steels since the full power of the machine is rarely used. With the higher cutting rates possible with carbides, older machines can easily become stalled, with possible damage to tools, workpieces and even the machine itself. To make sure that horsepower limitations are kept clearly in mind, it is good practice to clearly label the horsepower on each machine. It might be well, also, to indicate the maximum permissible metal-removal rate. A typical label is shown in *Fig.* 1.

One point to remember is that on larger machines, the table is sometimes fed separately—usually by

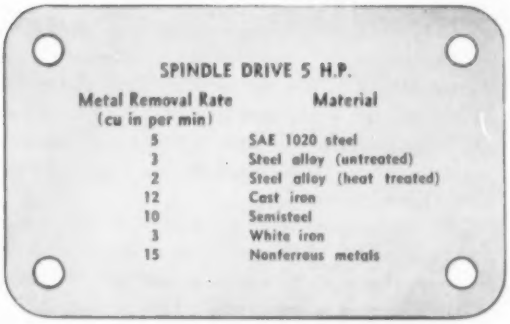


Fig. 1. Typical label, showing maximum amounts of metal removable with a spindle drive of 5 hp, that is attached to the machine.

a 5-horsepower motor. The power available in such a machine is the sum of the power of the drive spindle and the power of the table drive motor. For instance, when the spindle motor is 20 horsepower and the table drive is 5 horsepower, the total power available is 25 horsepower.

Machine Adjustment

After the motor has been wiped off and labeled, the V-Belts on the motor drive must be properly adjusted. Belts that provide half the motor rating power when operating at low speeds, slip frequently at full power and higher speeds. A simple adjustment applies the proper tension and readies them for heavier pulls. The clutch should also be adjusted.

On milling machines, longitudinal, transverse and vertical travel mechanisms should be checked and placed in proper alignment. This is accomplished by adjusting the tapered gibs holding the ways. It is sometimes necessary to scrape the ways before perfect alignment is obtained. Unless this adjustment is made, vibration occurs, which can ruin the cutter.

The wear that occurs between the table screw and nut should be compensated for by adjusting the split nut. However, only machines less than 20 years old are likely to be equipped with split nuts and climb nut adjusters. If the machine has no split nut, the worn solid nut should be replaced, to eliminate table screw movement or backlash.

Fitting the job to a machine is the last step in preparing for carbide machining. Important factors are the horsepower of the available machines and the type of material to be machined. Material may be evaluated by using a comparison chart, TABLE I, which shows the hardness of the material and the horsepower required to remove one cubic inch of material per minute.

The exact specifications of the material should be known. Some "cast irons," for instance, may be actually semisteels. There are numerous steels which have been made more machinable by the addition of lead. To take the hardness of these steels as the only criterion of machinability can be misleading. Many aluminum alloys are much tougher and require far greater horsepower in machining than virgin aluminum, so the specification "aluminum" is inadequate to permit evaluation of machinability.

Cutting Rates

Once the composition and machinability characteristics are known, it is possible to determine the most desirable cutting rate. Tables giving fpm are readily available so only a generalization will be given here.

CAST IRON: Cast irons are abrasive and cause faster tool wear than the tougher and stronger steels and steel alloys. Cutting speeds with carbides range from 350 to 150 fpm and may go even lower; for the chilled cast irons the rate may be as low as 100 fpm.

STEEL: The median cutting speed for steels, using carbide cutters, is 500 fpm. This cutting speed is raised or lowered according to the hardness of the steel. A straight carbon steel, 180 Bhn, can be milled easily at speeds as high as 750 to 900 fpm, with the newer carbides now available.

Cutting speeds for steels with hardnesses above 200 Bhn are as low as 100 fpm. Good tool life is obtained when machining alloys such as SAE 4340 steel, heat treated to $R_C 50$ or higher, at this same rate.

Once the cutting speed is chosen, the cutter can be selected. The cutter diameter will, of course, be determined by the dimensions of the workpiece. For face milling, a cutter approximately 60 percent larger in diameter than the width of the workpiece should be used. If the workpiece is 1 inch wide, for instance, the cutter should be $1\frac{3}{4}$ inches in diameter. The nearest standard size above this will suffice.

Calculating Speeds and Feeds: When the diameter of the cutter is known, and the cutting speed has been selected, the spindle speed is calculated: To give an example: a piece of SAE 1020 steel, 180 Bhn, with a one-inch wide face, is to be

face milled; the only available cutter is four inches in diameter. The speed chosen is 500 fpm. The distance around the circumference of the cutter is approximately one foot. Thus, in this case, a speed of 500 fpm is equivalent to 500 rpm. If the cutter is eight inches in diameter or two feet in circumfrence, the rpm rate is calculated by dividing 500 by 2, or 250 rpm.

As a final step, the feed rate—the rate at which the workpiece moves into the cutter—is calculated.

Table 1—Power Required To Remove Unit Volume of Metal in Unit Time
(one cubic inch per minute)

Material	Hardness (Bhn)	Power Required (hp)
Aluminum		¼ to ½
Cast iron	under 180	½
Cast iron	180-220	½
Steel	180-220	1
Steel alloy	220	1.5
Steel alloy (heat treated)	250-35	2.5
Steel alloy	over 350	3 to 4

First, the amount of metal to be removed by each tooth is determined. This is referred to as the tooth load or chip thickness.

In face milling, it is a good rule to cut not less than 0.005 inch thickness of chip for each tooth. In slotting, the chip thickness is usually less. For the majority of milling jobs, however, a chip thickness of 0.010 inch gives satisfactory results.

With the tooth load determined, the feed rate (ipt) can be calculated. Multiplying the chip thickness by the number of teeth in the cutter gives the distance the cutter travels into the workpiece in one revolution. This is referred to as the feed rate per revolution.

Next, the feed rate per revolution is multiplied by the number of revolutions per minute, giving the number of inches per minute (ipm) the cutter moves into the workpiece. Example: a face milling cut is to be made 1.0 inch wide on a workpiece made from SAE 1020 steel, 180 Bhn, using a 4-inch cutter having 6 teeth.

Calculation starts with selection of a chip thickness, assumed in this case to be 0.005 inch. With six teeth, this is equivalent to a feed per revolution of 0.030 inch. When the spindle is revolving at 500 rpm, the feed rate will be 15 ipm (0.030 inch times 500).

Putting the above information to work, a milling job can be analyzed as follows: the face to be milled is one inch wide and ⅛ inch deep; the feed rate is 15 ipm. These three factors are necessary to determine the amount of metal that will be removed in cubic inches per minute.

Multiplying one inch times ⅛ inch times 15 ipm shows that a little less than two cubic inches of metal are removed each minute. Since the component is SAE 1020 steel, 180 Bhn, the power required to remove one cubic inch per minute can be chosen as one, from TABLE 1. Hence, the power called for in the machine is two hp. A standard No. 2 knee type milling machine, in proper adjustment, will do a satisfactory job with a carbide face mill of traditional design. If a higher horsepower machine is available, the chip thickness can be increased to 0.010 inch and the feed rate can be doubled. The job can then be done with four hp with a feed rate of 30 ipm.

By comparison, this operation could not be performed at a rate above three to six ipm with a high-speed steel cutter. This indicates the beneficial results that can be obtained by using carbide cutters on older machines.

Grinding Story by Sound

Like many experienced grinding operators, those at Johnson Motors in Waukegan, Ill. depend on their ears to guide them when dressing a wheel. As they listen to the dressing tool during its pass across the wheel, sound tells them when the wheel has sparked out, indicating a properly dressed wheel.

As an aid to this "dressing by ear", Hi-Fi electronic equipment has been added at Johnson's to amplify the sound above other noises in the area and avoid guess work. The equipment is mounted on two Norton 6-in. angular wheel head grinders used to plunge grind the thrust face and bearing diameter on spiral gears used on Johnson seahorse outboard motors.

The Hi-Fi equipment consists of two sensitive crystal pick up units—one mounted on the dresser slide of each machine—a five-watt amplifier and a speaker. The latter two components are mounted in a cabinet to the rear and between the machines. A similar setup had been used earlier at George Gorton Machine Co.

Results indicate that sound amplification might be put to good use in industrial fields other than wheel dressing. Such equipment for example could be adapted to assembly operation to allow an operator to hear a part seating against a shoulder. It could be used too as an indication of load or volume where sound is a constantly relative factor.

Engineering and Tooling

emphasize speed, quality and dependability

By Ralph H. Eshelman
Associate Editor

As its own customer, Schlumberger can concentrate its engineering and manufacturing efforts on reliability and quality of product. As a result, unusual machines and setups have been developed for versatility and speed of operation. This article previews one of the outstanding plant tours awaiting ASTE members at the Annual Meeting.

DOUBTLESS, EVERY ENGINEER has dreamed of a mandate from management to produce the best possible product regardless of cost. For most, that mandate never comes. For engineers at Schlumberger Well Surveying Corp., Houston, Texas, this ideal is achieved.

Housed in a completely modern plant, recently constructed on a 40-acre plot along the Gulf Freeway, this firm's engineering and manufacturing activities are exceptional. The sole customer for their products is their own field force. Some 160

Fig. 1. Final assembly line of mobile truck units (left) and offshore units (right) at Schlumberger Well Surveying Corp. plant in Houston.

field offices in the United States and Canada provide a scientific surveying service for the petroleum industry. Basically, this service consists of charting by electrical measurements the geological formations in which an oil hole is bored. This data, when interpreted by an experienced petroleum engineer or specialist, furnishes much useful information to the drilling crew and has often resulted in productive wells or continuation of production from an apparently dry hole.

Methods used in electrical surveying are an extension of those developed by the founders of the company, Conrad and Marcel Schlumberger, two French engineers. While professor of physics at the Ecole Des Mines, Paris, researcher Conrad Schlumberger discovered that different kinds of rocks have distinct degrees of resistivity to passage of electrical current. He first applied this to a drill hole in September, 1927 to make a resistivity log, which made possible an educated guess of the nature of formations encountered and their content. Thus, a new tool was born for geophysical exploration.

Equipment and instruments used today are becoming increasingly complex and involve photographic, electronic and nuclear techniques as well as electrical methods. A sizable scientific research organization is maintained at Richfield, Conn. Its assignment is to investigate long-range, long-hair projects and ideas, determining their applicability to petroleum exploration.

Although the production facilities in Houston turn out both mobile truck units and skid units for offshore operations on a continuous basis, *Fig.* 1, emphasis is on engineering improvements and high quality. Volume of output is low, with about 12 units completed a month, but value of the product is high. Each unit contains about $50,000 in instruments and equipment. Basically, a mobile unit is a 10-wheel truck with a large power winch containing some thousands of feet of heavily armored

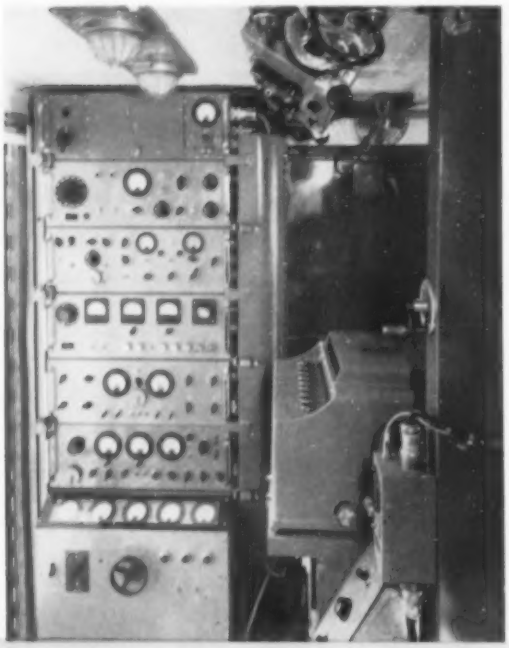


Fig. 2. Interior of mobile field laboratory is packed with scientific instruments for analyzing geological formations encountered in oil well drilling. Multiple recording unit, right center, provides a continuous photographic record. (Below) Frontal view of Schlumberger Plant in Houston.

electrical cable for lowering the instruments into the well hole. In the cab, *Fig.* 2, are standard panel racks and switchboards for the various electrical and electronic instruments and an automatic recorder as well as controls for winch and engine. The recording unit produces multiple-channel records on film.

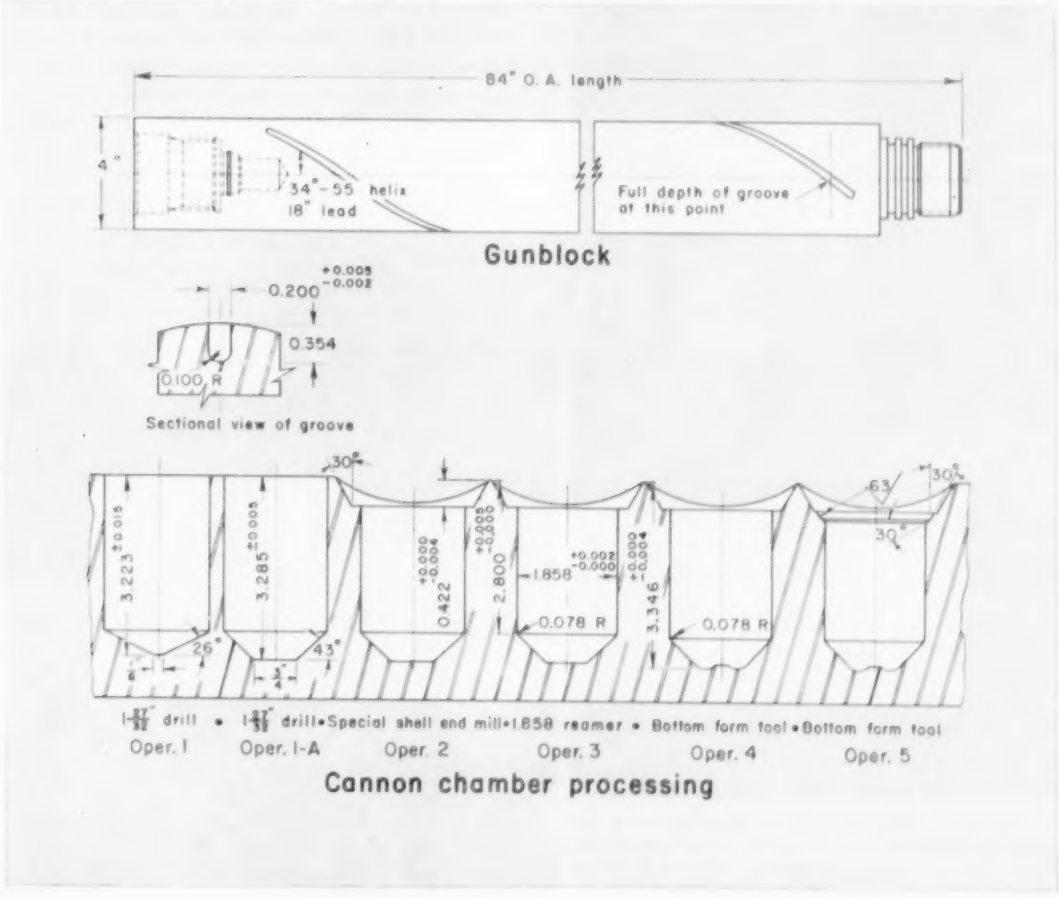
Since the company is a service organization and management philosophy is based on the premise that the best and most advanced scientific and engineering information must be utilized, facilities at the plant reflect this spirit. The engineering building is a two-story structure housing 12 electrical engineering laboratories, an engineering library and mechanical drafting and design rooms. One of the laboratories, housed in its related production area, is completely shielded to eliminate magnetic and stray electrical interferences. The walls of this room are lined with a double layer of steel plate. Structure of the building is entirely of wood. This building also houses the production group which assembles and calibrates induction type logging equipment.

Another laboratory is equipped for testing neutron logging equipment and gamma ray units. A special room is provided for experiments in processing of special radioactivity tubes. Near the engineering building is an "elephant bath" for simulating field conditions. The resistivity of the water in the bath can be varied to simulate actual conditions encountered in an oil well.

The engineering building has an unusual power distribution center connected into each of the laboratories, providing currents and voltages utilized in field work. The system enables an engineer to conduct tests under conditions closely paralleling actual use, without having to leave the laboratory or setting up basic equipment for each test.

In this setup, the major function of engineering is to try out new ideas for immediate development and application. The time element is vitally important. Once the idea has proved practical, every effort is

Fig. 3. Manufacturing drawing of oil-well gun showing detail of gun block, cannon chambers, flash holes.



made to develop the necessary equipment and produce it for field use without delay. The tempo of development is so fast that sometimes an item is virtually rendered obsolete before it can emerge from the experimental and prototype stage.

Organization of the company is closely linked to the engineering function. In fact, all of the major executives and department heads are themselves engineers with the exception of the controller and finance and legal executive. Under the president, the executive vice president has the responsibility for all operations. Reporting to him is the vice president of research. The vice president of engineering also reports to him and has responsibility for the four major engineering departments: engineering physics (research); electrical engineering; mechanical engineering, and production engineering.

Production engineering has the task of refining design of the numerous products and components developed by engineering. This department assembles all the related information, blueprints and field requirements needed for tooling and production. The information is reviewed to see what changes might be required for the estimated production. In this capacity it serves as an intermediary between the tool design group and product design to work out compromises when necessary and to determine that the twin requirements of design function and producibility are both met. Thus, this department handles all change requests and those for materials deviations.

Reliability of design is an important factor, since any failure of equipment in the field is serious. This problem is magnified with increasing use of electronic components. Because of advances in oil drilling techniques, much of the equipment is operated at ambient temperatures and under pressures for which it was not originally intended. Now, drilling has gone beyond 20,000 feet and former design limits of 400 F and 20,000 psi are rapidly being approached, sometimes exceeded.

Another related problem, with which production engineering as well as design must contend, is abnormal abuse equipment receives both in transportation to field sites and in use. Salt water operation in offshore drilling poses some particularly difficult problems of corrosion and erosion.

In connection with its design studies, production engineering may design certain details and redesign

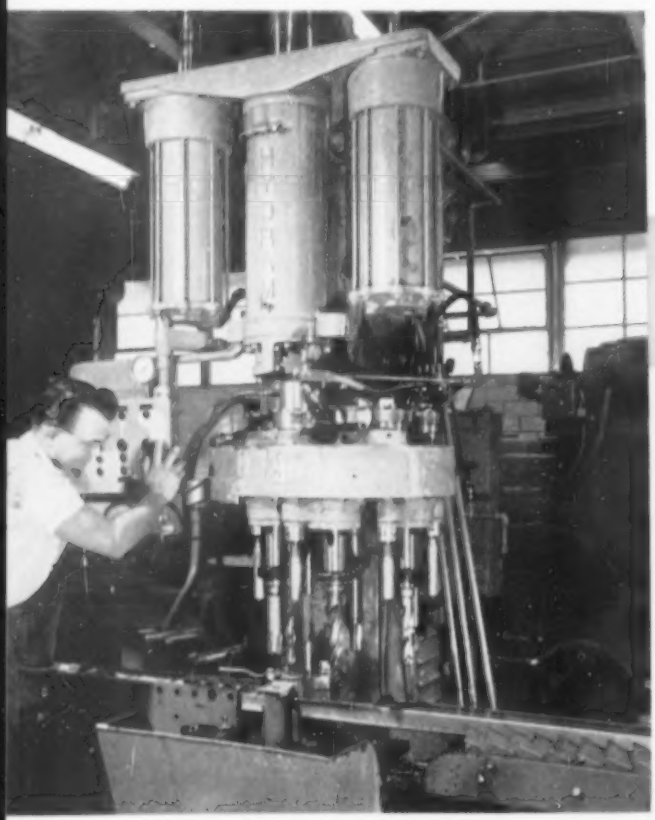


Fig. 4. Special 6-spindl turret drill developed for producing precision hol in parts such as gun block, *Fig.* 3. It is shown in process of drilling holes in sampler block of 4340 steel in annealed condition.

Fig. 5. (below) Another modified drilling unit, primarily to produce angular holes, is used to speed production of sampler blocks when not scheduled for gun blocks.

components for greater simplicity and reliability. In addition the department also has supervision of building of production prototypes of both electronic and mechanical types. This work is largely handled by the model shop, a complete production machine shop in miniature. Improvising is required extensively here and spinning, for instance, is used for many parts.

Production engineering also handles field testing of equipment, so has firsthand knowledge of how designs work out in actual conditions of use. In this connection, instruction and maintenance manuals are also a responsibility of this group.

Actual production facilities come under the manager of materials. In addition to machine and assembly shops and inventory control of completed equipment, the manager of material is responsible for manufacturing standards and production planning. Manufacturing standards includes the tooling function, design and approval of tools and processing methods.

Production planning is concerned with scheduling of production. With the manufacturing standards group it determines if facilities are available in the plant to manufacture a given part or subassembly, or whether certain items should be subcontracted to vendors. Many items, particularly electronic components, are purchased 100 percent. Because mechanical components often must operate near the extremes of physicals, it is often found best to produce critical items in company shops.

An example of the exacting nature of production requirements is shown by a recent shipment of wound coils purchased outside. In a lot of 50 not one was found satisfactory. As a result, the company is making plans to set up its own production of this item where quality can be controlled.

The management dictum of "spare no expense to do a good job, but get it out in a hurry," applies with particular force to machining operations, since many of the company-produced parts lie in this area. Tooling must be adapted to the job-lot conditions, yet precision must be carefully maintained within tolerances. Although many quality control methods are employed, inspection for critical parts must be 100 percent, because of need for absolute reliability.

The result is that tooling varies widely from simple, yet effective, shop setups to complex designs that are worked out to the finest detail. Many of the parts are unusual in shape since most of the instruments used in drilled wells are held to a maximum diameter of $3\frac{5}{8}$ inches. In some instances, the over-all diameter of the instruments must be as small as $1\frac{1}{16}$ inches. This is necessary because of wide variation in the diameter of oil well bores.

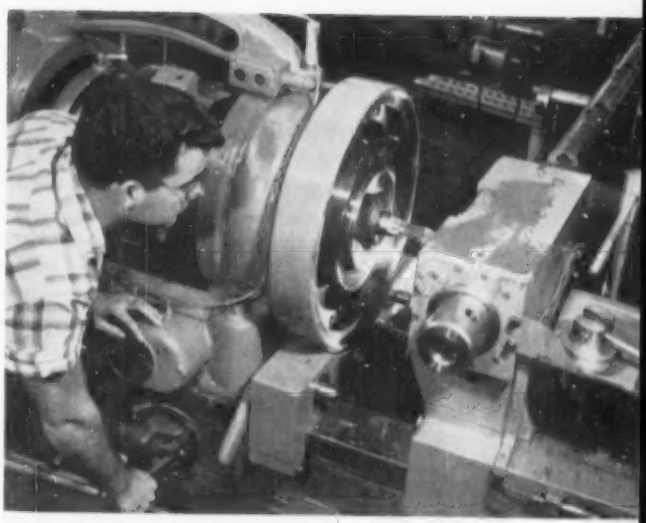


Fig. 6. Threading of cannon chambers is completed in a machine converted for this type of operation. Rubber wheel (upper right) supports the long workpiece.

The average diameter, however, is $7\frac{3}{4}$ inches.

Typifying production, a gun body, *Fig.* 3, of a type used for perforating wells, requires 392 machining operations. Any one of these may result in scrap of the part. Some of the more difficult and interesting operations include milling the groove around the periphery, machining the ends, producing the firing chambers and drilling the interconnecting channels.

Material for this part is 4340 steel bar stock received in hardened condition, 38-43 Rockwell C, with no more than a 3-point spread allowed in any one bar. Each bar is sampled for uniformity and hardness to make certain it meets specifications. The part is then machined in as-received condition to avoid problems of distortion that were encountered when attempts were made to heat treat after processing.

Special equipment was designed by the manufacturing standards group to meet the problems involved. Tooling for these gun blocks involves precision drilling, reaming, sizing and forming 30 chamber holes. Holes must be spaced 3 inches ± 0.002 inch apart. Each chamber is machined to close tolerance on depth, chamfer and bottom form. The bottom form and chamfers require a 63-microfinish to insure close volume control. Any one of these 30 chambers that does not meet these specifications would cause rejection of the part.

By modifying a Barnes Hydram to a 6-spindle turret, *Fig.* 4, basic requirements are met and at the same time cost per gun has been reduced by 60 percent. The turret housing was designed to be

mounted on a 7-inch ram to slide on dovetail ways. A set of hardened and ground helical gears with radius tip and full fillet root with a ratio of 3:35:1 was selected to drive the spindles. All spindles are hardened and ground with preloaded bearings and adjustable end thrust. These gears and spindles are lubricated by an oil mist. Coolant is fed to each spindle through special seals, permitting continuous flow over each tool. Between each spindle there is an adjustable dwell stop that permits tool adjustments for correct depths. Also, by dwelling these tools, desired microfinish is secured. If, at any time, a tool becomes dull, the ram will retract automatically. To insure correct dwelling, an indicator is built into the stationary stop that engages the dewll stop.

The operator panel consists of six pushbutton controls. These buttons control the starting motor, cooling pump, advancing ram, returning ram, indexing turret and vacuum cleaner. Locking the indexing turret and positioning the spindles are controlled by hydraulic cylinders and precision switches. In operating the pushbutton control, the turret cannot be indexed unless the ram has been retracted. The same safety features are on the advance feed. It will not operate unless the turret is locked and locating pin engaged. Without spindle rotation, the ram can be advanced and returned with ease by air-operated cylinders. This feature accomplishes the purpose of setting tools with Jo-blocks and adjusting dwell stops.

All tools have a rapid advance to within $\frac{1}{16}$ inch of work before engaging feed. This was made possible by designing a small 6-position turret with adjustable cams that actuate the rapid, fine and coarse feeds. The small 6-position turret is synchronized with the rotation of the large turret by bevel gears and flexible cable.

A ratchet rack and runner actuated by an air cylinder moves the workpiece forward. The chamber indexing fixture accurately locates the chamber holes to 3 inches plus or minus 0.002 inch. With this and other special machines, comparatively unskilled operators can be employed, releasing skilled machinists for work requiring more complex setups.

A modified Morey thread drill is used to mill the spiral groove on the gun body. Angular holes such as required on this part and others are produced rapidly on a modified horizontal 6-spindle Burgomaster to which has been added a pneumatic feed control, *Fig.* 5. From an economic standpoint, standard drill heads were used in planning the tooling for angle drilling. These heads are used on other fixtures. Tooling these heads to a fabricated table simplified the operation of drilling bisecting holes at a given angle and location.

The final operation of threading the cannon chambers is performed in a Planetary machine with the gun body supported in a special fixture, *Fig.* 6. For this operation it was necessary to design a table that would move to a positive stop and lock into position. Also, a method of clamping the gun and accurately locating each chamber hole in relation to the center of the spindle was needed. A special cutter was designed to adapt to the nose spindle.

The special table moves on square ways actuated by an air cylinder with a cushion stroke. It is accurately located by adjustable micrometer stops and rigidly cam locked to square ways.

The clamping fixture is designed with hardened and ground collets hydraulically controlled by a special power unit. A removable cam lock locating plug is designed on the clamping fixture to locate each chamber hole. An electric bell signal is connected to the hydraulic system to tell the operator that the collets are closed. A rubber tire wheel on an adjustable stand supports the gun and at the same time allows for deflection.

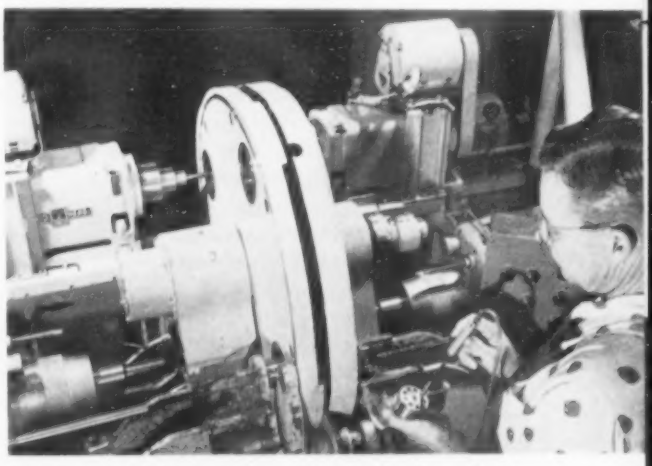


Fig. 7. Special horizontal machine built of standard components is used to machine instrument head. Each workpiece is cycled through the three work stations; the fourth station is for loading and unloading. Thus, three parts are processed simultaneously with operations performed from both sides.

Special nonstopping cut-form eccentric relief cutters were designed to form 6 pitch and 46-mm threads. These cutters are adapted to a No. 40 milling taper with hardened and ground adapter and have coolant holes in each flute. There are other special setups that have been ingeniously devised to solve problems of fast and accurate produc-

tion. One of these is a special vernier punch for the sheet metal turret press, which permits orienting punch locations at any three-degree position throughout the circumference of a circle.

Another unusual application is a special double-end machine, *Fig.* 7, for drilling and boring holes in each side of an instrument head, *Fig.* 8. This horizontal drill makes possible multiple operations without repositioning the work. Counterbored holes had to be concentric within 0.005 inch total indicator reading with opposite counterbored holes, *Fig.* 8. A horizontal machine was best suited to drilling from opposite ends as shavings were less troublesome.

Six drill units operate on sliding dovetail ways to perform drilling, rough counterboring and finish boring. On each of the sliding tables are mounted a self-contained hydraulic unit with a torque counterbore and a head that has a precision boring attachment for finish counterboring. Feed travel on the latter unit is accomplished by a separate table actuated by hydraulic cylinders.

Workpieces are held in a trunnion which rotates on roller bearing supports. On one end of the trunnion shaft there is an electric collector that actuates precision switches. These switches operate air cylinders that are built into the trunnion to lock the 9-position collet adapters. A seal on the opposite end of the trunnion shaft supplies air to the four air cylinders inside the trunnion. When the trunnion is locked in position by dowel pins, the 9-position collet adapters can be rotated by sprocket and double roller chain. With the dowel pins disengaged and the collet adapters locked, the trunnion is free to rotate and is positioned by the sprocket and double-roller chain.

A separate 50-gallon hydraulic unit supplies hydraulic pressure to the head, slide table and slide. This unit has a 225-lb variable-volume pump and a 1000-psi pump driven by a 5-hp motor. Another pump driven by a 2-hp motor supplies coolant to all cutting tools.

The operator control panel has a total of 22 pushbutton controls and one hand switch. The automatic cycle button will not operate if the collet adapters are not locked, nor when the table slides are not in position; neither will the automatic cycle start without coolant flow. By use of this setup much greater accuracy can be maintained consistently than would be possible with a standard multiple machine on this particular part. This machine was developed to reduce time required for the operations, resulting in an estimated reduction in a ratio of 8 to 1 over a conventional setup.

Assembly operations on electrical and electronic components largely is conventional benchwork. While control and switch panels involve no special problems, some of the instrument heads are unusual because of space and shape restrictions. As shown in *Fig.* 9, "packaging" all the components into an assembly is a real art. As components become more complex, miniaturization techniques are being developed or adapted from guided missile experience.

One of the special features of the production shop is a Gamma-ray washroom, required for some of the newer nuclear type instruments. In this area, parts for the Gamma-ray detector tubes are washed.

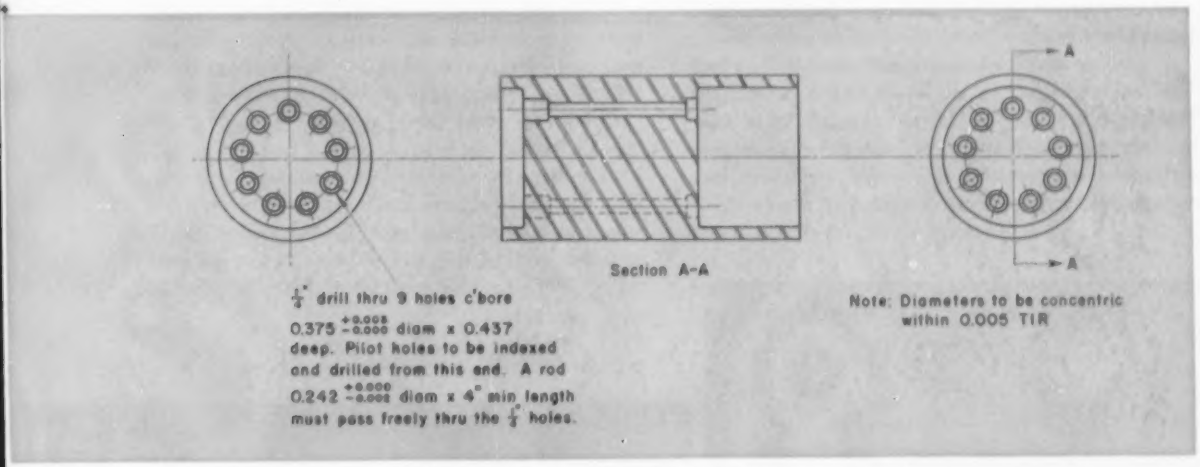

A
A
Section A-A
1/4" drill thru 9 holes c'bore
0.375 +0.005 -0.000 diam x 0.437
deep. Pilot holes to be indexed
and drilled from this end. A rod
0.242 +0.000 -0.002 diam x 4" min length
must pass freely thru the 1/4" holes.
Note: Diameters to be concentric
within 0.005 TIR

Fig. 8. Manufacturing drawing of instrument head.

A medical type of sterility must be maintained in these operations. A separate air-conditioning unit is provided to prevent air pollution since corrosive acids are used in the process.

Building up the chassis and cabs, both mobile trucks and skid units, resembles custom type automotive operations, making extensive use of assembly fixtures. Of particular interest in this area is an utility island, *Fig.* 10. This is a self-contained welding unit with all the requirements for these operations neatly packaged in the center of the floor where it is easily accessible but yet is out of the way when not required.

While the company is not large as corporations go, having about 4000 employees, it is outstanding in the field of employee relations. Labor turnover is no problem. Generous pension and hospitalization plans cover all employees. In addition, there is a profit-sharing plan which usually increases the employee's annual pay by a substantial percentage.

These, perhaps, are merely outward manifestations of the confidence placed in personnel by the company. It is assumed that each employee works for the best interests of the firm, to the best of his ability with or without supervision. As a result of this confidence, employees are conscientious and uniformly proud of their work and their organization. There is no union representation in the plant.

Engineers in the company are accorded a professional status the same as scientific personnel. For instance, all engineers are encouraged to belong and participate actively in at least one engineering or professional society. The company covers the expenses of such membership. Further, if any engineer can establish that any supplies or equipment are required for his projects, he gets them. All drafting supplies and equipment are furnished.

A specific example of this policy applies to technical books and publications. When an engineering library was established, rather than having the librarian order books to fill the shelves, engineers requisition any books or publications they feel necessary or worthwhile in their work. After they have finished with them, the books are sent to the library to be cataloged and shelved. In this way, a double purpose is served. Only books which tech-personnel in the organization believe valuable are ordered. Second, all engineers have a personal interest in their reference library.

Because electrical engineers are expected to make the decisions and demonstrate complete responsibility for their individual projects, usually only well experienced engineers are sought for these positions. Mechanical engineering, however, provides an opportunity for developing experience on the drafting board. Often, engineers enter the company in this area of engineering directly from college.

In order to maintain and cultivate technical competence, the company provides at least one engineering training course during each year. This usually is a 15-week course on some closely allied subject, such as petroleum engineering, mathematics or geology. These courses are held in a well equipped lecture auditorium once a week, immediately after the close of work. Text material is usually furnished.

Attendance is voluntary but turnouts are excellent. The chief engineer and department heads often attend and participate freely in discussions. This, as much as anything, is indicative of the spirit of the organization, and accounts for the high quality of its products.

Fig. 9. (above) Assembly room where electrical components are completed. Instrument in foreground shows compactness of such installations.

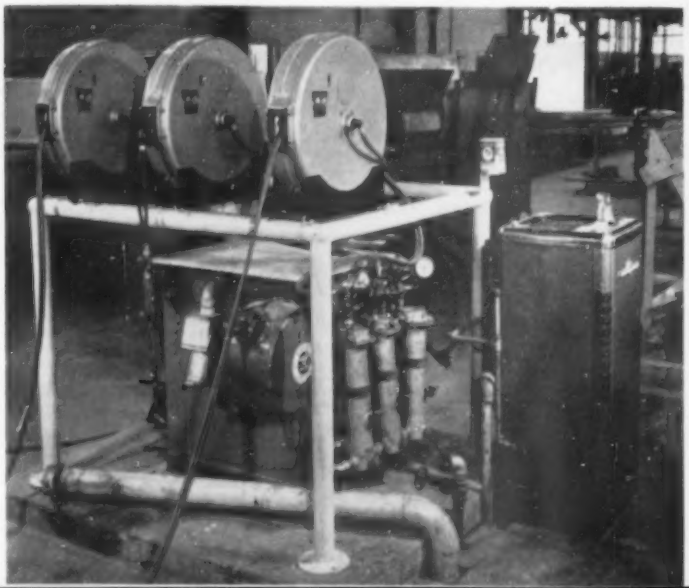


Fig. 10. (right) Utility island in truck shop results in cleaner as well as safer plant conditions, is more efficient.

feeds and speeds

for turning with ceramic tools

DURING THE PAST several years, ceramic cutting tools have created a great deal of interest. In general, this interest stems from the fact that cutting speeds are 50 percent greater than those usually recommended for carbide tools.

Ceramics have less shear strength and resistance to mechanical shock than conventional tool materials. These characteristics, plus the higher feeds and speeds obtainable, make it mandatory to hold machine and tool vibrations to a minimum during cutting. Normally, coolants are not required. If welding of chips takes place, however, a plentiful flow of coolant, well distributed over the tool, may be necessary.

Tools should be clamped with uniform pressure; precision-ground tool clamping surfaces give best results. Diamond wheels are used for all tool grinding. Cutting edges should be honed to a land of 0.005 to 0.010 inch at an angle of 45 deg. Cutting surfaces of tools used for light finishing cuts on ferrous metals and for all types of cuts on nonferrous metals should be polished. Some other recommendations with respect to tool design are:

- Negative rake angles are best for heavy cuts.
- Neutral to positive rake angles are best for light cuts in ferrous metals, and for turning nonferrous and nonmetallic materials.
- End and side relief angles of 5 to 7 deg are preferred.
- The 5-deg angle is most suitable for hard materials.
- A 1/32-inch nose radius is best for average turning.
- Larger radii are desirable for heavy cuts and for turning materials such as cast iron.
- Side-cutting edge angles of from 15 to 30 deg should be used whenever possible.
- When cutting badly scaled workpieces, a negative rake, high side-cutting edge angle, and either a large nose radius or honed cutting edge, or both, will give superior results.

Feeds and speeds for turning a representative group of materials are given in TABLES 1 through 10. The many material and machining variables make it difficult to establish definite speed and feed

Table 1—Plain Carbon and Alloy Steels

Material (AISI No.)	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability (percent)
B1112	190	1000-1500	0.010-0.030	100
C1117	121	950-1100	0.006-0.012	85
C1141	174	900-1000	0.010-0.012	65
C1020	111	600-1000	0.010-0.025	65
C1040	149	600- 900	0.010-0.020	60
C1045	200	600- 900	0.010-0.020	60
C1340	202	500- 600	0.010-0.020	45
A2340	223	475- 550	0.006-0.015	45
A3140	210	750- 900	0.010-0.020	55
A4023	175	730-1200	0.010-0.025	70
A4140	197	650- 850	0.010-0.020	60
A4145	217	600-1050	0.005-0.016	55
A4615	190	750- 850	0.006-0.014	65
A4640	183	600- 850	0.010-0.020	55
A5150	207	650-1100	0.005-0.016	55
NE8617	149	800-1000	0.006-0.014	65
NE8640	179	750- 900	0.010-0.020	60
TS81B40	179	750- 900	0.010-0.020	60
TS81B45	217	700-1200	0.005-0.016	55

Data furnished by Diamonite Products Manufacturing Company.

rates for each application. In many cases, it may be necessary to modify the cutting rates shown by actual test with the workpiece material, machine and setup used in production.

The machinability ratings indicated for ferrous materials are based on B1112 Bessemer screw stock = 100 percent. The machinability rating for copper alloys is based on free-cutting brass = 100 percent. Relative machinability of materials for which numerical ratings have not been established is indicated by "Excellent," "Good," "Fair," and "Poor."

Table 2—Heat-Treated Alloy Steels

Material (AISI No.)	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability (percent)
A2345	300	450-600	0.006-0.015	25
A3140	300	500-650	0.008-0.020	30
A4145	300	500-700	0.010-0.025	35
A4340	300	500-650	0.008-0.020	30
A4640	300	600-800	0.010-0.025	40
A5140	300	500-650	0.008-0.020	30
A6145	300	450-600	0.006-0.015	25
NE8645	300	500-700	0.010-0.025	35

Table 3—Annealed Tool Steels

Material (type)	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability (percent)
Plain carbon	195	450-700	0.005-0.015	50
Manganese	210	400-600	0.005-0.015	45
High carbon cr.	229	350-500	0.004-0.012	25
Low tungsten cr.	212	350-500	0.004-0.012	35
High tungsten 2	230	400-550	0.004-0.012	40
High speed	230	250-500	0.004-0.010	30
S-495		75-200	0.008-0.020	Poor
Nickel	100	350-550	0.012-0.020	Fair
Timken Graph-Mo	212	500-750	0.015-0.025	Good
19-9 DL		300-600	0.010-0.025	Good
Hastelloy B	210	75-200	0.008-0.020	Fair
Hastelloy C	185	75-200	0.008-0.020	Fair
Hastelloy D (85% Ni		50-150	0.008-0.020	Poor

Table 4—Cast Iron

Material (type)	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability (percent)
Ferritic	120	750-1000	0.010-0.020	120
Nodular	170	750-1000	0.010-0.020	90
Coarse pearlite	197	700- 850	0.007-0.018	90
Fine pearlite	218	500- 700	0.007-0.018	80
5% carbide	240	400- 600	0.007-0.018	50
Mottled	270	300- 500	0.010-0.025	40
Malleable	140	700- 900	0.007-0.018	50
Chilled	350	150- 200	0.007-0.025	40
Chilled	450	100- 150	0.007-0.025	

Table 5—Cold Drawn Nickel Alloys

Material (type)	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability Rating
Duro nickel	160	250-500	0.006-0.020	Fair
Monel	125	200-450	0.006-0.020	Good
K-Monel	160	200-400	0.005-0.015	Excellent
R-Monel	145	250-600	0.006-0.020	Good
KR-Monel	185	250-600	0.006-0.020	Good
Hastelloy A	210	200-400	0.005-0.015	Good
Illium R	190	200-400	0.005-0.015	Fair

Table 6—Copper Alloys

Material (type)	Hardness (Rockwell B)	Speed (sfpm)	Feed (ipr)	Machinability (percent)
Free-cutting brass	78	2000-3000	0.007-0.020	100
Low-leaded brass	80	2000-3000	0.007-0.020	70
High-leaded brass	80	2000-3000	0.007-0.020	90
Leaded naval brass	82	2000-3000	0.007-0.020	70
Leaded copper	...	2000-3000	0.007-0.020	80
Architectural bronze	...	2000-3000	0.007-0.020	90
Rod brass	77	1600-2000	0.007-0.018	30
Low brass	82	1600-2000	0.007-0.018	30
Muntz metal	75	1600-2000	0.007-0.018	40
Naval brass	82	1600-2000	0.007-0.018	30
Cartridge brass	82	1600-2000	0.007-0.018	30
Leaded nickel-silver	88	1600-2000	0.007-0.018	50
Copper	50	1000-1600	0.005-0.015	20
Aluminum bronze	95	1000-1600	0.005-0.015	20
Nickel silver	90	1000-1600	0.005-0.015	20
Commercial bronze	70	1000-1600	0.005-0.015	20
Beryllium copper	102	1000-1600	0.005-0.015	20
Phosphor bronze	90	1000-1600	0.005-0.015	30
Everdur 1012	...	1500-2500	0.007-0.020	60
Merculoy No. 420	95	1000-1500	0.005-0.015	30
Olympic bronze type D	...	1500-2500	0.007-0.020	60
P.M.C. No. 95	...	1500-2500	0.007-0.020	65

Table 7—Wrought Aluminum Alloys

Alloy (Alcoa No.)	Hardness (Bhn-500 kg.)	Speed (sfpm)	Feed (ipr)	Machinability Rating
25-O	23	1000 - 4000	0.004 - 0.010	Good
25-H	44	1000 - 4000	0.004 - 0.010	Good
35-O	28	1000 - 4000	0.004 - 0.010	Good
35-H	55	1000 - 4000	0.004 - 0.010	Good
115-T3	95	1600 - 10,000	0.004 - 0.012	Excellent
175-O	45	1600 - 10,000	0.004 - 0.012	Good
175-T	100	1600 - 10,000	0.004 - 0.012	Excellent
245-O	42	1600 - 10,000	0.004 - 0.012	Good
245-T	105	1600 - 10,000	0.004 - 0.012	Excellent
535-O	45	1000 - 4000	0.004 - 0.010	Good
525-H	85	1000 - 4000	0.004 - 0.010	Good
535-O	26	1000 - 4000	0.004 - 0.010	Good
535-W	65	1000 - 4000	0.004 - 0.010	Good
535-T	80	1000 - 4000	0.004 - 0.010	Good
615-O	30	1600 - 10,000	0.004 - 0.012	Good
615-W	65	1000 - 4000	0.004 - 0.010	Good
615-T	95	1000 - 4000	0.004 - 0.010	Good

Table 8—Aluminum Forging Alloys

Material	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Machinability Rating
145-T	130	1000 - 4000	0.004 - 0.010	Excellent
175-T	100	1000 - 4000	0.004 - 0.010	Excellent
185-T	100	1000 - 4000	0.004 - 0.010	Excellent
255-T	100	1000 - 4000	0.004 - 0.010	Good
325-T	115	1000 - 4000	0.004 - 0.010	Good
A51S-T	90	1000 - 4000	0.004 - 0.010	Good
535-T	75	1000 - 4000	0.004 - 0.010	Good

Table 9—Aluminum, Magnesium and Zinc Alloys

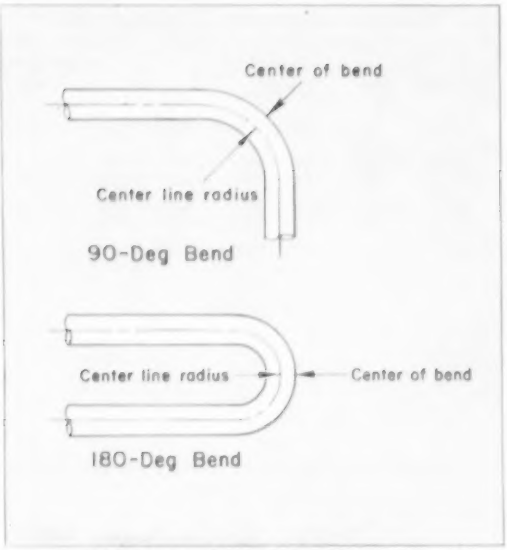
Material	Hardness (Bhn)	Speed (sfpm)	Feed (ipr)	Relative Machinability
Al, Mn and Zn Alloys	45 - 75	500 - 3500	0.010 - 0.025	Free Machining

Table 10—Plastics

Material (type)	Speed (sfpm)	Feed (ipr)
Thermoplastic:	600-3000	0.004-0.010
Cellulose nitrate Cellulose acetate		
Cellulose acetate-butyrate Vinyl esters		
Polystyrenes Vinylidene chloride		
Ethyl cellulose Methyl metheorylate		
Polyethylene Nylon		
Thermosetting:	300-2000	0.004-0.010
Phenol formaldehyde Phenol furfaraldehyde		
Urea formaldehyde Melamine formaldehyde		
Polyesters		

Physical Properties of

BENT TUBING



Typical bends in thin-wall tubing.

Many companies are using cold-bent tubing to replace welded elbows. This has not only reduced manufacturing costs, but has resulted in a better product. Experiments have shown that cold-bent tubing is actually stronger than straight tubing, owning to work-hardening which results when the tube wall is thinned during the bending operation.

When bending four-inch diameter stainless steel tubing to a center line radius of six inches, for instance, the outside wall thickness is reduced from 0.025 to 0.020 inch. The yield strength of the tube is increased from 66,000 to 110,000 psi. A comparable increase in strength is noted in other materials, including aluminum.

Pertinent physical characteristics of stainless steel and aluminum tubing, before and after bending, are listed in the accompanying table. Strength and hardness measurements were taken at the center of bend, as shown in the illustration.

Data furnished by Pines Engineering Co., Aurora, Ill.

Properties of Bent Tubing

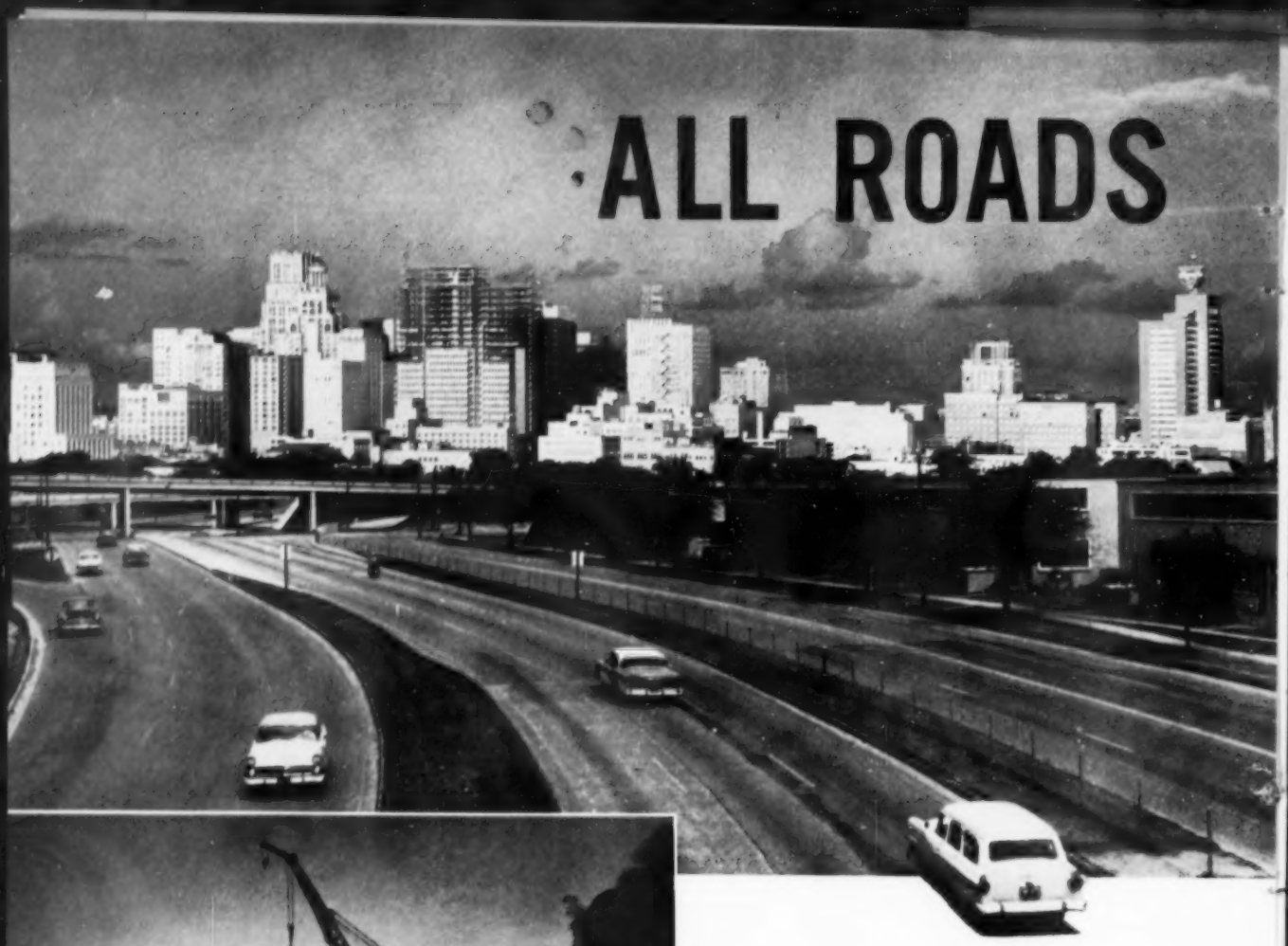
Physical Characteristics of Tube Bends

Characteristic	Shape	Material Type: Stainless Steel 321	Stainless Steel 321	Stainless Steel 321	Stainless Steel 304	Stainless Steel 321	Aluminum 3S
Outside Diameter (inches)		4	4	3.5	3	3.5	4
Center Line Radius (inches)		6	6	5.75	3.5	5.3	8
Amount of Bend (deg)		90	90	90	180	90	90
Outside Wall Thickness (inch)	straight	0.025	0.0345	0.021	0.062	0.040	0.063
	bent	0.020	0.027	0.016	0.046	0.030	0.049
Reduction in Wall Thickness (percent)		20	27.52	23.8	25.8	25	22.2
Tensile Strength (psi)	straight	103,330	92,970	116,080	97,800	116,750	20,480
	bent	129,280	145,800	149,380	156,700	145,210	22,700
Yield Strength (psi)	straight	66,670	51,020	78,970	57,640	101,080	18,880
	bent	110,260	124,440	126,580	138,600	109,570	21,115
Max. Elongation in Two-Inch Length (percent)	straight	25	40.5	11.5	37.0	18.5	11.0
	bent	12.5	6.5	5.0	5.0	7.5	7.0
Hardness (Vickers 20 kg)	straight	165	158	250	160	207	44
	bent	270	335	305	315	275	45

25th Annual CONVENTION

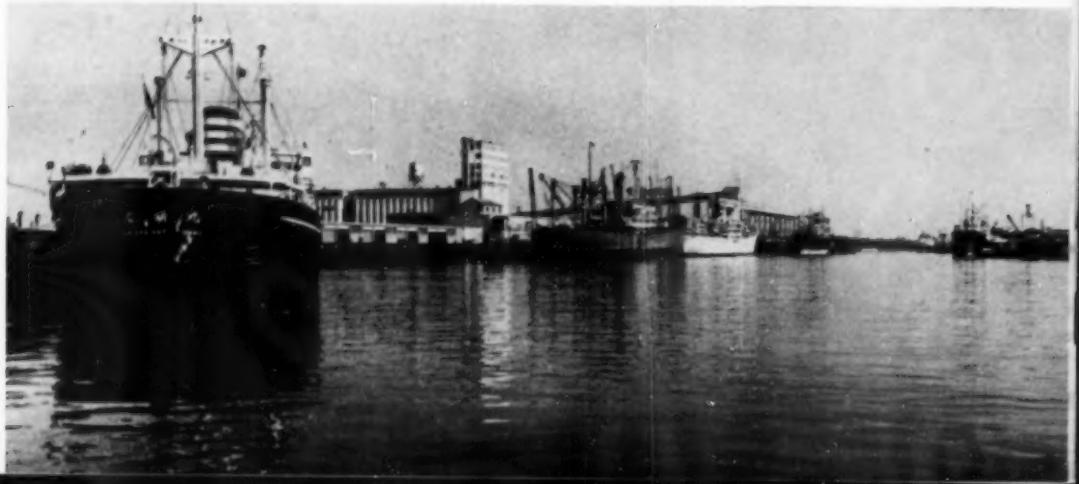
Commemorating twenty-five years of progress in tool engineering, the above motto and symbol have been adopted for use during ASTE's Silver Anniversary Year. The chief function of the tool engineer—making more and better products available to more people at less cost—is described by the motto, "A Better Life Through Creative Manufacturing." The tool engineer's creative manufacturing ability is symbolized by the "all-seeing" eye.

ALL ROADS



Both land and sea yield to the insistent search for new sources of crude oil and gas. Offshore drilling operations such as the one shown left are a common sight in this petroleum region. A Robert Yarnall Richie photo.

Deep water—the Port of Houston—is a magnet which has drawn to the city an unparalleled concentration of industrial production. This picture courtesy of Houston Chamber of Commerce.



LEAD TO Houston

General Sam Houston, from whom the city takes its name, led the Texas army to a decisive victory against Mexico at San Jacinto, four months before Houston was founded.

Often called the "Convention City of the South," Houston offers visitors a variety of recreational facilities, an almost perfect climate, and a Southern-bred friendliness that makes all feel welcome.

Swimming, boating, and deep-sea fishing are but a few of the sports that can be enjoyed here. The green waters and white sand beaches of the Gulf are only a few freeway minutes from the heart of Houston, while the city itself abounds in beautiful residential areas, famed garden spots, richly historical shrines, and a civic center and shopping district second to few in the country.

Houston's average temperature in the spring is 69 degrees and the humidity, highest at sunrise, quickly drops to near zero at noon, making the balmy atmosphere completely comfortable.

Born midpoint in the country's largest cattle-raising belt, Houston has since turned its sights below ground, to the rich petroleum deposits surrounding the city. Its industry is keyed to the needs of the oil industry—well surveying, equipment for drilling rigs, processing plants for the raw material.

A major petroleum producer, Houston has also become a market for chemical products, lumber, and the cotton grown nearby.

A rail and shipping center, it also boasts an abundance of air transportation, and the surrounding highways and freeways make auto travel a pleasure.

Perhaps its most charming aspect is the fact that it is Texas personified. Ranches and cowboys, battlegrounds and historic shrines, rodeos and circuses play no small part in its attraction for a people raised with a belief in the "Romance of Texas."

Cattle-raising, an occupation of the early settlers in the Houston area, has continued to be an important activity with rail facilities helping to speed the marketing.

A BETTER LIFE THROUGH CREATIVE MANUFACTURING

The Tool Engineer is vitally interested in upholding the welfare of our American economic system and is a key figure in promoting the American goal of increasingly higher living standards for everybody, through the manufacture of better products for more people at minimum prices.

Modern manufacturing requirements were responsible for the founding of the American Society of Tool Engineers in 1932 by a handful of men endowed with extraordinary vision and courage. At a time of industrial stagnation, these tool engineers recognized that our country's economic growth would depend largely on the development of mass manufacturing. They saw the place of the tool engineer in industry when manufacturing was at a standstill. Their objectives in forming a professional tool engineering society were three-fold: to be of service to each other, to industry and to industrial management.

The history of ASTE has been the continual growth of an organization of men dedicated to self-improvement in their profession: a history of ever increasing aid to industry in manufacturing and production methods and procedures. The growth of our Society has accompanied the phenomenal growth of tool engineering as a profession in the past quarter century. The need for a greater knowledge in the tool engineering field has resulted in the formation of 145 chapters of the Society in the United States and Canada and a membership exceeding 37,000.

Today, the American Society of Tool Engineers is one of the world's largest and most progressive technical societies and has achieved recognition for the tool engineering profession, and for the individual tool engineer in industry. Today, as well, we are industry's chief guide in the advancement of scientific knowledge in manufacturing and production and an important influence in the field of engineering education.

This year of 1957 is ASTE's Silver Anniversary, to be celebrated throughout the United States and Canada.

ASTE is rededicated to advancing the American standard of—

"A BETTER LIFE THROUGH CREATIVE MANUFACTURING"

H. C. McMillen

President, 1956

technical conference

Previews of various technical sessions scheduled for the convention are presented here, completing the coverage of industrial conferences which began with the publishing of symposia papers in THE TOOL ENGINEER for February. Included also are photographs and biographical sketches of the authors and speakers.

A conference on oil industry tooling techniques will include the paper *Special Machine Tools for the Oil Industry* by **William F. Ridgway,** sales engineer for Ingersoll Milling Machine Co. Although based on practices in the oil industry, this paper describes the philosophy of special vs. general-purpose machine tools, which is applicable to all industry. Examples illustrate how special machine tools should be considered, how they should be developed and the types of limitations that should be imposed on them. Completing the oil industry tooling conference is **Wiley B. Noble** of Reed Roller Bit Co.'s *Threads that Hold the String Together*. This string is the many lengths of pipe used in the drilling of deep holes in the ground to reach deposits of oil, gas, water or sulfur. Sections of the pipe are held together by joints that have coarse-pitched, steeply tapered threads, which are of prime interest because of the loads they must carry and

Ridgway

Noble

WILLIAM F. RIDGWAY, sales engineer for The Ingersoll Milling Machine Co. of Rockford, has had 26 years' experience with the company, including work in electrical engineering, design, development, service and sales. A mechanical engineering graduate of University of Illinois, Mr. Ridgway belongs to ASTE's Rockford chapter. During the past 12 years he has worked extensively with people in the oil industry, helping design special machine tools to meet their specific production requirements.

WILEY B. NOBLE is vice president and chief engineer, and also a director, for Reed Roller Bit Co., Houston. He received his B.S. degree in mechanical engineering at Rice Institute in Houston. Starting with Reed Roller Bit in the patent department, he subsequently progressed through the engineering department, holding positions as draftsman, field engineer, development engineer, assistant chief engineer, and war products engineer, to his present position.

Rubenson

Butterworth

Ellis

Halverstadt

JOSEPH G. RUBENSON, section head in the Department of Special Systems and Components, Airborne Instruments Laboratory, Inc., received his B.S. in physics from New York's City College, and his M.E. from Polytechnic Institute of Brooklyn. His automation experience includes working with electronic methods for precision measurements, data-handling in digital and analog systems, and feed-back control for machine tools. He has also worked with electronic countermeasures for the Armed Forces.

GREIG S. BUTTERWORTH is project engineer for the Cincinnati Milling Machine Co. Formerly with Airborne Instruments Laboratory, Inc., his activities have been principally in the fields of automation for the machine tool industry and electronic countermeasures for the armed forces. His automation experience has been with precision measurements and feedback control. He received his B.E.E. degree from Pratt Institute, and his M.E.E. degree from Polytechnic Institute of Brooklyn, and belongs to Tau Beta Pi and Sigma Xi

ENS. JENS L. WENNBERG, now on active naval duty, received his B.S. in M. E. from the University of Missouri last June, majoring in tool engineering. He has done research under Prof. E. K. Henriksen on titanium chip breaking, with support from Titanium Metals Corp. of America and Watertown Arsenal, and presented a paper on this subject to the ASME Student Convention last April. He has, for the past two years, been a student instructor, teaching basic machine-shop practices.

CLIFFORD T. APPLETON, president of Reed Rolled Thread Die Co., Worcester, has worked with machine and small tools industries in various capacities, including engineering, manufacturing, and sales. Since joining his company in 1941, he has contributed to the development and application of the thread-rolling process. He has lectured and written a number of articles and technical papers on this subject. Mr. Appleton is a graduate mechanical engineer from Pratt Institute in Brooklyn.

JOHN L. ELLIS, chief engineer of Sintercast Corp. of America, Yonkers, received his technical training in Germany and Belgium, graduating from Brussels University's engineering school. Starting as machine designer in the pencil industry, Mr. Ellis progressed to developing hydraulic presses and related equipment for molding and coining powdered metals with Hydropress, Inc. His present job entails developing new types of sintered alloys, particularly wear-resistant and heat-resistant carbides.

R. D. HALVERSTADT is supervisor of the Metalworking Laboratory of General Electric Co.'s Jet Engine Dept., Cincinnati. After graduating from Case Institute of Technology in 1951 as a mechanical engineer, he began with GE as design engineer, advancing to his present position in 1953. He had previously worked for Republic Steel Corp. in Cleveland, serving their formal four-year apprenticeship program. Mr. Halverstadt is a registered professional engineer, and a member of ASME and Sigma Xi.

Wennberg

Appleton

the pressures they must withstand. The author describes the care with which these threads are made.

One of the recent advances in tool engineering is *The Inchworm Motor*, covered by **Joseph G. Rubenson** of Airborne Instruments Laboratory, Inc., and **Greig S. Butterworth,** project engineer for the Cincinnati Milling Machine Co. This motor is a mechanism for locating one part of a machine with great precision, in relation to a fixed point or to another part of the machine. It is based on the phenomenon of magnetostriction—the characteristic of change in physical dimension of certain materials when placed in a magnetic field.

As a result of several years of research, a new family of cemented carbide tool and die materials has been developed. This material combines the advantages of conventional carbides with those of tool steel, and is described fully in a paper by **John L. Ellis,** chief engineer of Sintercast Corp. *A Machinable, Heat Treatable and Weldable Cemented Carbide for Tooling Purposes* discloses that the new carbide is primarily for use in wear rather than cutting applications at its present stage of development.

Under the heading, "Designer—Tool Engineer Cooperation," come two papers: one from **R. D. Halverstadt** of General Electric's Cincinnati Jet Engine department; and one by **Ens. Jens L. Wennberg,** now on active naval duty, and formerly connected with Watertown Arsenal's titanium

Bergman

Kennedy

Zlatin

Weller

JOHN W. BERGMAN is supervisor of Methods and Equipment Development, Manufacturing Engineering, Aircraft Gas Turbine Div. of General Electric, Cincinnati. A graduate of GE's apprentice training and manufacturing training programs, he has held positions of inspection supervisor, foreman, general foreman, and superintendent with GE since 1936. He has been in manufacturing engineering for the past three years.

W. B. KENNEDY is chief of the experimental machining branch, Rodman Laboratory, Watertown Arsenal. He attended General Electric Technical School, with courses at MIT, Tufts, and Franklin Institute. Fifteen of his twenty years of tool engineering experience have been in planning development programs, working with tool steels low in strategic alloys, and tool and cutting oils. An industrial consultant on machining problems for a variety of companies, he has gained recognition as a lecturer and author. He is a registered engineer in Massachusetts.

NORMAN ZLATIN, consultant for Wright Aeronautical Div., Curtiss-Wright Corp., had seven years' experience with Cincinnati Milling Machine Co. As research engineer, he worked on the development of new machines, metal-cutting research, and allied problems. These included developing instruments for measuring forces and tool temperatures, cutting fluid research, and metallographic analysis. Mr. Zlatin holds an E.E. degree and a B.S. in M.E. from the University of Cincinnati, and is registered in Ohio.

E. J. WELLER, who has been with General Electric since 1937, joined the Metallurgical Products Department three years ago, and is currently manager of the carbide products design engineering section of that department. A member of the metal-cutting committee of ASME and the subcommittee on cemented carbides of ASTM, Mr. Weller has authored several articles on improved tool designs and machining practices.

research project. In Mr. Halverstadt's *Design for Machining Heat-Resistant Alloys*, he recognizes that, because of difficulties in processing high-temperature alloys, the design engineer must be cognizant of production problems so that total costs can be minimized. The author presents general principles that should be followed in material selection, design geometry, dimensioning and finishing requirements.

In *Chip-Breaking Characteristics of Titanium*, Mr. Wennberg describes research into the chip-breaking characteristics of carbon steel, stainless steel, and titanium. Information is presented so that machining processes can be set up to produce desirable types of chips. Feeds, speeds, bending radii, and chip-breaker dimensions are all covered.

In the session covering unique rolling techniques, **Clifford T. Appleton,** president of Reed Roller Thread Die Co., indicates the versatility of application of the thread and form rolling process. His *Fundamentals and Application of Thread and Form Rolling* reviews the tools and equipment used for both large and small-production quantities. *Another Revolutionary Process—Power Roll Forming*, by **John W. Bergman** of General Electric's Aircraft Gas Turbine Div., describes the process by which sheet stock or blanks are formed to the shape of a rotating mandrel. Unlike conventional spinning, where the material thickness remains constant, power roll forming plastically deforms the material and improves many of its physical properties.

A panel on ceramic tools in service, a part of the ceramic tool symposium, will consist of four papers, of which one, *Ceramic Tools—the Challenge of Physical Properties* by E. W. Engle and G. W. Barnes, was reviewed last month. Of the others, *Experimental Machining with Ceramics* by **Wallace B. Kennedy** of Rodman Laboratory, Watertown Arsenal, describes more laboratory cutting experience with ceramic tools, including some early results with milling cutters. These data are interesting especially because they come from the laboratory that created the recent interest in ceramic cutting tools in the United States.

Ceramic Machining Development by **Norman Zlatin,** consultant for Wright Aeronautical Division, Curtiss-Wright Corp., tells of the laboratory

technical conferences

machining tests that were used to help evaluate ceramic tools and determine where they should be applied in production. This presentation tends to diminish, somewhat, the initial claims that were made regarding the use of ceramics. High cutting speeds are not the only requirement for successful use. **E. J. Weller,** of General Electric's Metallurgical Products Department, in his paper titled *Cemented Oxide Cutting Tools in Service,* reports on the preparation that should precede the use of ceramic cutting tools in production applications. This includes a review of the machines available, the grinding procedures used and the particular jobs that are under consideration. Several case histories are included to indicate some of the results that are currently being obtained.

The "Why" of Registration and the Benefits Accruing to Those Affected is authored by **W. M. Andrews,** a partner of the consulting engineering firm of Lockwood, Andrews and Newman. The introduction to the session on registration benefits to the tool engineer, this paper points out that the major benefits resulting from registration of engineers must be in the public's interest. Benefits accruing to the engineering profession come as a result of the conduct of individuals in relation to the laws. Although the general public is the major gainer as a result of such registration, **C. Y. Thomas,** vice president of Spencer Chemical Co., points out that engineers and industrialists have a large stake in such activity. In *Registration—Industry's Point of View,* he gives the industrialist's view toward professional engineering.

How standards affect the tool engineer is the topic of another technical meeting, with papers presented by **S. David Hoffman,** LL.B., representing American Standards Association, Inc., and **John Q. Holmes,** director of the Production Engineering Section of General Motors Technical Center. Mr. Hoffman's paper, *Standardization and the Legal Eagles* explains the various antitrust laws and acts so that those in any way connected with standardization can guard against violations of the law. He also indicates the position of the legal profession and mentions ways in which lawyers can help avoid violations in the formulation and practice of standardization.

The Joint Industry Committee (JIC) came into being because there was a need for standards that considered the requirements of equipment users and the economical limitations imposed on equipment builders. Mr. Holmes' *Conception and Development of JIC Standards* tells some of the story behind JIC and the standards it has developed.

WILLIAM M. ANDREWS is a partner in the consulting engineering firm of Lockwood, Andrews and Newman of Houston. He spent three and a half years in the industrial engineering department of the Houston Lighting and Power Co., followed by twenty-one and a half years with his present firm. Holder of a B.S. in mechanical engineering from Texas A & M College, he is a registered professional engineer in Louisiana and Texas. Mr. Andrews is on his state's engineering registration board, and is a member of NSPE and Texas SPE, ASME, ASHAE, and Tau Beta Pi.

C. Y. THOMAS, vice president of operations, Spencer Chemical Co., graduated from Purdue University, receiving his B.S. in mechanical engineering in 1921, and his M.E. in 1926. He joined his company when it was organized in 1941, becoming chief engineer and acting manager. Mr. Thomas was a director for Kansas on the board of the NSPE, of which he has also been regional vice president. He also belongs to ASME and AIMME, Kansas Engineering Society, and Kansas Council of Engineers and Architects.

S. DAVID HOFFMAN, head of the Electrical Engineering Dept. of the American Standards Association, is an attorney, and a member of the New York State Bar. He holds degrees in engineering from Yale and in law from St. John's University. Prior to becoming connected with ASA in 1949, he was equipment engineer with Western Electric Co., Inc. Mr. Hoffman is assistant secretary of the U. S. National Committee of the International Electrotechnical Commission, and last year attended meetings in Munich, Germany, as member of the American Delegation.

JOHN Q. HOLMES, director of production engineering for General Motors Corp., graduated from Worcester Polytechnic Institute in 1900, with a B.S. in mechanical engineering. Mr. Holmes has held various design jobs with Delco-Remy Div. of G.M. and, during the war, became assistant chief engineer for Eastern Aircraft Div., manufacturing the Grumman Wildcat, later working on the F-84-F Republic Thunderjet. He has also been director of Tool and Process Engineering at Buick-Oldsmobile-Pontiac Div.

Andrews

Thomas

Hoffman

Holmes

An industrial conference covering the tool engineer's relationship to management starts off with **Herbert R. Belcher's** *Labor Control in Aircraft Repair*. The author is a management consultant for Ernst & Ernst in Houston and, although he uses aircraft repair as an example, he emphasizes the principles of planned use of manpower which can be applied to a wide variety of industries. He presents methods of setting work standards and discusses the control of costs. In the same session **S. E. Scharff,** also of Ernst & Ernst, reports that former methods of tool selection are no longer sufficient under present circumstances, in *Some Economics Aspects of Machine Tool Selection*. As the author indicates, the economics of any machine tool must be measured in terms of direct and indirect labor, maintenance, overhead, operating costs, power consumption, obsolescence, etc. All factors that have a bearing on the selection of a tool should be considered.

Because residual stresses can be serious troublemakers, renewed interest is being exhibited in the study of their formation and elimination. **Erik K. Henriksen,** senior tool engineer at Convair in Fort Worth, gives detailed information on what the stresses are, how they are being formed, and what to do to eliminate them, in a paper titled *Residual Stresses from Machining Operations*. **J. A. Harrington,** chief engineer of The DoAll Co., covers *Stress and High Temperature in Grinding* in the same session. He gives an account of the failures of critical parts resulting from stresses created by improper grinding techniques. Recommendations are made for proper grinding and cooling methods to minimize residual stresses.

The engineering behind an earth satellite launch-

Belcher

Scharff

HERBERT R. BELCHER, management consultant for Ernst & Ernst in Houston, graduated from Texas Technological College in industrial engineering in 1947. Prior to joining Ernst & Ernst four years ago, he had experience in stock control, production control, time study, and methods and systems analysis. A registered professional engineer in Texas, Mr. Belcher is also a member of American Institute of Industrial Engineers.

S. E. SCHARFF is district supervisor of industrial engineering with Ernst & Ernst, having some 18 years of consulting experience behind him. A graduate of Cornell University's electrical engineering school, he also spent four years in design engineering. Mr. Scharff has been president, regional vice president, and chairman of the National Committee for Professional Registration for the Houston chapter of AIIE, and is a member of the Texas Society of Professional Engineers.

E. K. HENRIKSEN, senior tool engineer at Convair in Fort Worth, was born and educated in Denmark. Upon graduation from the Royal Danish Technical University with an M.S. in mechanical engineering, he held positions in England, Germany, and Denmark. For the past 24 years he has taught mechanical engineering, mainly metal-cutting and machine tools, both here and in Denmark. Mr. Henriksen has designed various machine tools and instruments, has written articles and student texts, and has conducted research on stress formation and distribution, design of chip breakers, and rigidity of machine tools.

J. A. HARRINGTON, chief engineer of the DoAll Co., Grinder Div., has had experience in both the practical and design aspects of engineering. A graduate of Massachusetts Institute of Technology, he has coauthored books on precision dimensional control, and lectured before student and professional groups on quality control, surface finish, wheel dressing and surface grinding. A member of ASTE, ASME, and ASQC, he is national chairman of the Engineering Div. at the Instrument Society of America.

MAHLON A. WINTER is manufacturing manager of Martin Co.'s Project Vanguard. Associated with Martin since 1941 in engineering, quality control, and manufacturing research, he was one of the inventors of the "Marform" process for forming sheet metal by using rubber dies. During World War II, he spent two years on the B-29 project in Seattle, and has since worked on the development of the Viking rocket. Mr. Winter is a graduate of the U. S. Naval Academy, and of Massachusetts Institute of Technology.

RAYMOND G. SIPE is tool project engineer for the Martin Co. on Project Vanguard, the project to produce a three-stage rocket vehicle which will launch the first man-made earth satellite. He joined his company as assemblyman in 1939, and has continued to advance in his positions, having supervised such projects as the Martin Mercator and the Amphibian Mariner. Mr. Sipe obtained his advanced education through night courses at his company, and at various institutions in Baltimore.

Henriksen

Harrington

Winter

Sipe

ing is a topic of great interest to those who would be well informed on this timely subject. *Project Vanguard—Launching the Man-Made Moon* is **Mahlon A. Winter's** contribution to this program. As manufacturing manager of Martin Co.'s Project Vanguard, he is able to give an insight into the preparations for launching the rocket-powered earth satellite vehicle. **Raymond G. Sipe,** tool project engineer working on the same project, will present *Tool Engineering for Project Vanguard*, in which he discloses the techniques, soon to become more commonplace, for working high-strength alloys.

The closing ceremonies of the plastic tooling symposium will be climaxed by a panel: "Plastic Tools in Service." Following Benjamin Sokol's account of *The Repair of Plastic Tools* and W. J. Arrufat's *Plastic Tooling for Small Parts*, previewed last month, **Edsel Ruddiman,** representative of Ford Motor Co.'s Tool and Die Design Dept., will speak on his *Experiences with Plastic Tooling in the Stamping Plant*. Manufacturers have long looked for a method of inexpensive punch and die construction whereby short-run stamping tools would be economical. Mr. Ruddiman reports on the building and use of duplicate steel and plastic dies so that costs can be directly compared, and operations tested under identical conditions.

Concluding the panel presentation will be a paper prepared jointly by **W. Robert Price** of General Mills' Kankakee Chemical Development Dept., and **D. E. Peerman** of the Chemical Research Laboratories of General Mills in Minneapolis. Titled *Polyamide Resin Alloys in Practical Tooling Applications*, the paper tells of alloys of polyamide and epoxy resins for application as production tools. These alloys result in a material having most of the advantages and few of the disadvantages of both resins, so far as tooling applications are concerned.

Completing the report of speakers for the plastic tooling symposium, **William R. Weaver,** president of Modern Pattern and Plastics, Inc., will answer the question *What Are the Known Limitations of Plastic Tools?* Plastic tooling, still in its infancy, has stirred the imagination of tool engineers because it can be applied in ways that former tool materials cannot be used. Mr. Weaver correlates the limitations of plastic tooling imposed by the physical properties of present raw materials.

Ruddiman

Price

Peerman

Weaver

EDSEL RUDDIMAN is a graduate of Henry Ford Trade School and attended also the University of Michigan and the Detroit Institute of Technology, majoring in mechanical engineering. He has been an employee of the Ford Motor Co. since 1938, in the Tool and Die Design Department. He is now a supervisor in charge of Progressive Die Design and Special Assignments, including plastic tooling as used in the press shop.

W. ROBERT PRICE JR. is project manager of Plastics and Resins, Commercial Chemical Development Dept., Chemical Div., General Mills, Inc., Kankakee, Ill. His work is concerned with the use of polyamide resins in tool and die applications. Formerly in charge of product development for the Georgia Kaolin Co., Mr. Price graduated from Cleveland's Case Institute with a B.S. in chemical engineering, and took extended training at North Dakota School of Agriculture and Newark College of Engineering.

D. E. PEERMAN is research chemist with General Mills, Inc.'s Minneapolis Chemical Research Laboratories. During the past five years, he has been associated with the applications section of the research group, engaged in applications research on plastics and resinous materials. Having studied polyamides combined with epoxies as plastic tooling materials, he has authored several papers on the subject.

WILLIAM R. WEAVER is president of Modern Pattern and Plastics, Incorporated of Toledo. He received his technical training at Purdue University, holding a bachelor's degree in mechanical engineering. Mr. Weaver is chairman of the Central United States Plastic Tooling Steering Committee. His paper will cover known limitations in plastic tooling.

Convention

what, when, and where

Houston and ASTE will welcome convention-goers arriving for the six-day annual event with a full and varied program of activities. From the time the ladies get together at a welcoming reception on Saturday, till the dust settles from the Thursday afternoon rodeo, the days (and evenings, too) will be packed with the best the city, the climate, and the Houston Host Committee can offer.

After checking into the luxurious Shamrock-Hilton Hotel, early-arriving Houston visitors will first be invited to the Honor Awards Dinner, to be held in the Emerald Room at 6 o'clock Saturday evening. The dinner will provide the background for the yearly presentation of ASTE's six meritorious awards.

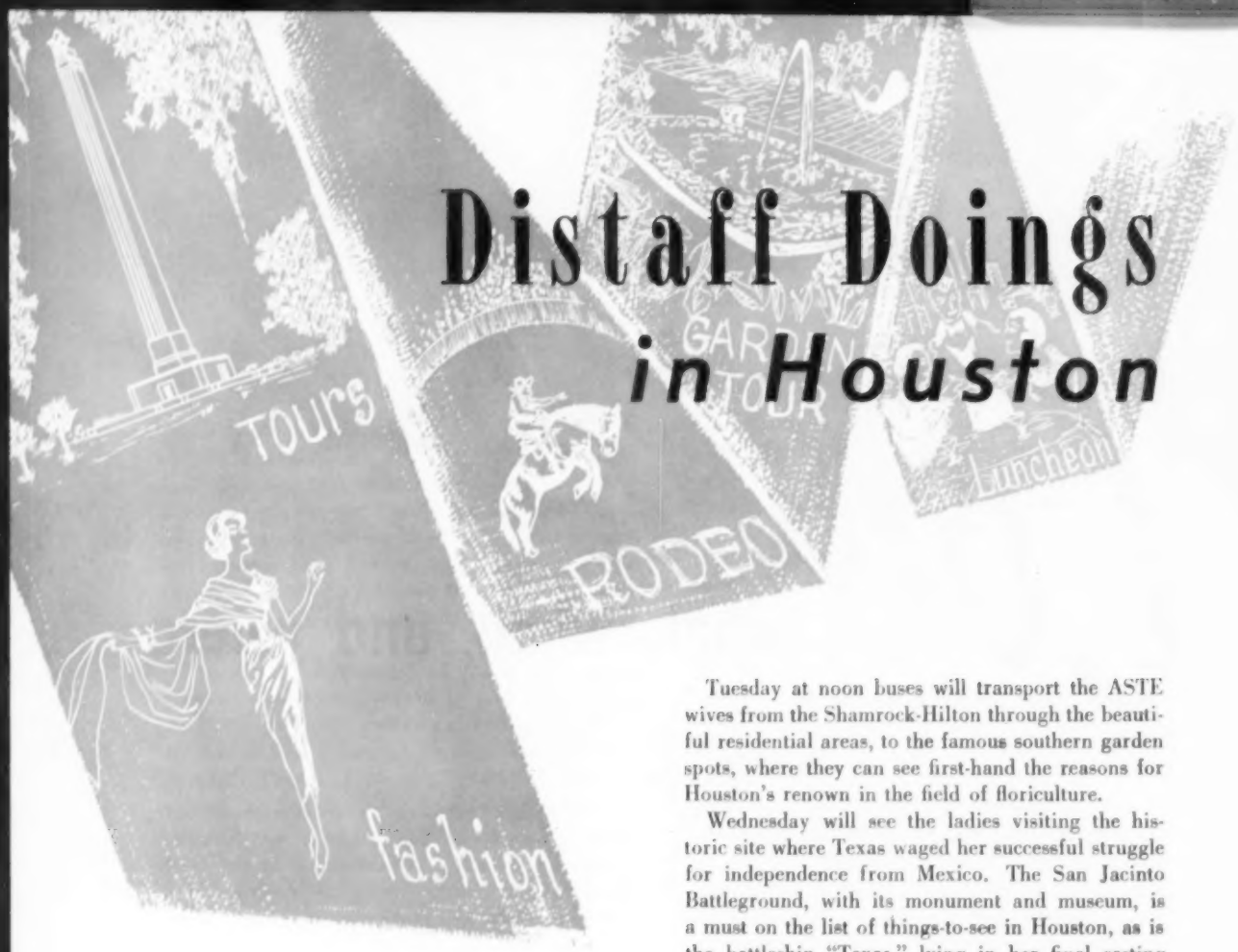
The Oil Industry Committee and Houston chapter have collaborated on the Sunday evening program entitled "The Romance of Oil," which boasts not only a speaker from the Hughes Tool Co., but a color film, *The Evolution of the Oil Industry*, and the "Magic Barrel" act.

Feature event of the week-long calendar of activities is the Silver Anniversary Dinner, slated for the Emerald Room of the Shamrock-Hilton at 6 p.m. on Monday. Immediately preceded by a social hour on the hotel's Aquatic Terrace, the dinner will set the stage for the Silver Anniversary Celebration, to be broadcast by closed-circuit audio transmission to chapters all over North America.

During the broadcast, ASTE will receive salutes from nationally known dignitaries; national and chapter officers, both those present and those remaining at home will be installed; and the chartering of the first "off-shore" ASTE chapter—Sydney, Australia—will be consummated by telephone. Principal speaker for the banquet will be The Honorable Dudley C. Sharp, Assistant Secretary of the Air Force, who will probe the question of "Industrial Readiness and National Defense."

Thursday, the final day of an action-filled week, will leave conventioneers with the tang of Texas, for the Houston chapter members have arranged a barbecue and rodeo. At the H & H Ranch at 12 noon on that day, barbecued beef and ribs, with "Texas trimmings" will be the menu. At 2 p.m. a rodeo at the Humble Rodeo Grounds will abound with clowns and such western specialties as calf roping, steer dogging, and bull riding, to say nothing of a ladies' barrel race.

Throughout most of the convention proceedings, a Texas hospitality suite will be maintained in the Shamrock-Hilton Hotel, where visitors can take time out to lounge and refresh themselves.



Distaff Doings in Houston

Houston is preparing a royal welcome for ASTE wives who accompany their convention-going husbands to the Sunny South in March. A welcoming tea at 2 p.m. Saturday afternoon in the Shamrock Room of the Shamrock-Hilton Hotel will give the visiting lady her first taste of Texas hospitality.

To make her stay enjoyable while her husband sits in on technical conferences or tours local industry, a convention committee under the chairmanship of L. F. Skelly has planned a full and varied program for the ASTE wife. The schedule includes a tour of Houston's famous azalea gardens and redbud trees, a trip to the historic San Jacinto Battleground, a shopping trip, complete with style show and luncheon at a leading store, plus a Texas-style rodeo and barbecue.

The Venetian Room of the Shamrock-Hilton Hotel has been reserved exclusively as "Ladies Headquarters," where Mrs. ASTE can chat with old friends and meet new ones, indulge in an occasional bridge game, and in other ways just relax.

The Aquatic Terrace beside the Shamrock's pool, offers an excellent place to lounge in the sun, when milady is not enjoying the pool's clear waters.

Tuesday at noon buses will transport the ASTE wives from the Shamrock-Hilton through the beautiful residential areas, to the famous southern garden spots, where they can see first-hand the reasons for Houston's renown in the field of floriculture.

Wednesday will see the ladies visiting the historic site where Texas waged her successful struggle for independence from Mexico. The San Jacinto Battleground, with its monument and museum, is a must on the list of things-to-see in Houston, as is the battleship "Texas," lying in her final resting place nearby. A seafood luncheon at the San Jacinto Inn will provide a breathing space for the foot-weary tourists. Buses will leave the hotel at 9 a.m., and return with their passengers at 4:30 p.m.

Another excuse to don comfortable shoes is the shopping expedition, planned for Wednesday morning and afternoon. Again buses will leave at 9:30 a.m., and return to the hotel at 4 p.m. Besides touring the downtown store area, and stopping for luncheon and a western fashion show at a leading store, the women will have a chance to view the world's largest suburban shopping center, "Gulfgate."

Tickets for the three special tours just mentioned will be available in the Ladies Headquarters at the hotel. The flower tour will cost $2.00 for transportation while the price of the San Jacinto tour, including lunch, will be $6.00, and the shopping tour, with lunch, will cost $5.00.

As a final send-off to the visiting wives, the host committee has planned as a mixed gathering the barbecue and rodeo mentioned elsewhere. And of course the ladies are invited to accompany their husband to the Honor Awards Dinner on Saturday, the "Romance of Oil" program on Sunday, and the gala Silver Anniversary Social Hours and Dinner Monday evening.

SATURDAY, MARCH 23

2 p.m., Shamrock Room, Shamrock-Hilton Hotel

Ladies Tea

6 p.m., Emerald Room, Shamrock-Hilton Hotel

Honor Awards Dinner

Ladies and guests invited to the dinner featuring presentation of ASTE's six meritorious awards.

8 p.m., Grecian Room, Shamrock-Hilton Hotel

National Delegates Conference

Annual Conference for National Delegates and Alternates.

SUNDAY, MARCH 24

1 to 5 p.m., Emerald Room, Shamrock-Hilton Hotel

National Delegates Conference

Closed session for election of 1957-58 ASTE National Directors

1:30 to 5 p.m., Shamrock Room, Shamrock-Hilton Hotel

Board of Directors Meeting

Annual meeting of ASTE Board of Directors. Members are welcome to attend.

8:30 p.m., Emerald Room, Shamrock-Hilton Hotel

Romance of Oil

Mixed gathering sponsored by Houston chapter members and the Oil Industry Information Committee. Program includes Speaker Lyle L. Payne, of Hughes Tool Co.; color film, *Evolution of the Oil Industry;* and "The Magic Barrel" act. Ladies and guests are invited.

Registration and Ticket Sales
Exhibits Building

Saturday, March 23	9:30 a.m. to 6:00 p.m.
Sunday, March 24	9:30 a.m. to 8:30 p.m.
Monday, March 25	7:30 a.m. to 5:00 p.m.
Tuesday, March 26	7:30 a.m. to 8:00 p.m.
Wednesday, March 27	7:30 a.m. to 8:00 p.m.

timetable for

MONDAY

9 a.m., Grecian Room, Shamrock-Hilton Hotel

Oil Industry Tooling Techniques

"Special Machine Tools for the Oil Country" (#15)—William F. Ridgway, Sales Engineer of Ingersoll Milling Machine Co.

"Threads that Hold the String Together." (#16)—Wiley B. Noble, Vice President of Engineering, Reed Roller Bit Co.

9:30 a.m., Emerald Room, Shamrock-Hilton Hotel

Ceramic Tool Symposium

"Background and Properties of Oxide Cutting tools" (#17)—Robert F. Rea, Manager, Product Engineering, Stupakoff Div., Carborundum Co.

"Review of Published Russian Work" (#18)—Nathan H. Cook, Assistant Professor of Mechanical Engineering, MIT.

1:00 p.m., Emerald Room, Shamrock-Hilton Hotel

Ceramic Tool Symposium

"Ceramic Tool Geometry and Preparation (#19)—Harry D. Moore, Associate Professor, and Donald R. Kibbey, Instructor, Dept. of Industrial Engineering, Ohio State University.

"A Comparison of Workpiece Finish Produced by Ceramic and Carbide Cutting Tools" (#20)—Milton C. Shaw, Professor, Metals Processing Div., Mechanical Engineering Dept., MIT.

Industrial tours scheduled for Monday, March 25, are: Tour #1—Reed Roller Bit Co.; Tour #2—An Oil Well Drilling Rig.

Arrangements for these tours can be made on the preregistration blank on page 156. Buses will depart from the Shamrock-Hilton Hotel at 8:30 a.m. for the Reed Roller Bit tour, and at 1:15 p.m. for the Oil Well Rig.

March 25

1:30 p.m., Shamrock Room, Shamrock-Hilton Hotel

Recent Tool Engineering Advances

"A Machinable, Heat Treatable and Weldable Cemented Carbide for Tooling Purposes" (#13)—John L. Ellis, Chief Engineer, Sintercast Corp. of America.

"The Inchworm Motor" (#14)—Joseph G. Rubenson, Section Head, Special Systems and Components Dept., Airborne Instruments Laboratory, Inc.; and Greig S. Butterworth, Project Engineer, Cincinnati Milling Machine Co.

2:00 p.m., Grecian Room, Shamrock-Hilton Hotel

Designer—Tool Engineer Cooperation

"Design for Machining High Temperature Alloys" (#7)—Robert D. Halverstadt, Supervisor, Metalworking Laboratory, Jet Engine Dept., Aircraft Gas Turbine Div., General Electric Co.

"Chip Breaking Characteristics of Titanium" (#8)—Jens L. Wennberg, Ensign USNR, Naval Harbor Defense Unit, Los Angeles.

ASTE Center

Located in the Exhibits Building, an annex to the Shamrock-Hilton Hotel, the ASTE Center will serve as the convention nucleus for the following:

Registration and ticket sales (if you have not preregistered.) Any available tickets for the Honor Awards Dinner, Silver Anniversary Social Hour, Silver Anniversary Dinner, Plant Tours, Rodeo and Barbecue, and transportation to the Rodeo.

There will also be a lounge where you can relax at intervals in your busy schedule.

Dudley C. Sharp Will Deliver Silver Anniversary Dinner Address

As Assistant Secretary of the Air Force, and having also an extensive background as a leading industrialist in the manufacture of oilfield equipment, The Honorable Dudley C. Sharp is eminently qualified to address the 25th Annual ASTE Banquet audience on Monday evening.

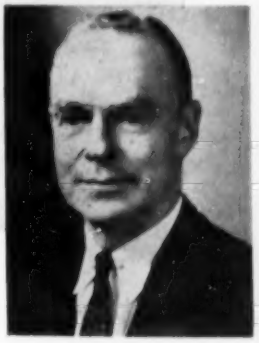
For years, his interest in the problems of tooling and machine design has been keen, both as an industrialist and a government official.

As president of Mission Manufacturing Co. prior to his resignation in September 1955, Mr. Sharp led the company from a small machine shop to a leading producer of oilwell equipment. A Princeton graduate, he went to work in the machine shop of the then Mission Sales Co. A self-taught draftsman, and not an engineer by training, he designed some of Mission's early products.

For eight months prior to his present job in charge of Material for the Air Force, Mr. Sharp served as consultant on machine tool stockpiling to General E. W. Rawlings, Director of Air Material Command.

Hon. Dudley C. Sharp

Official
Air Force Photo



timetable for TUESDAY

9:00 a.m., Shamrock Room, Shamrock-Hilton Hotel

Unique Rolling Techniques

"Fundamentals and Application of Thread and Form Rolling" (#11)—Clifford T. Appleton, Vice President, Reed Rolled Thread Die Co.

"Another Revolutionary Process—Power Roll Forming" (#12)—J. W. Bergman, Supervisor, Methods and Equipment Development, Manufacturing Engineering, EOD Components and Overhaul, Aircraft Gas Turbine Div., General Electric Co.

9:30 a.m., Emerald Room, Shamrock-Hilton Hotel

Ceramic Tool Symposium

"Cutting Tool Temperatures" (#21)—Nathan H. Cook, Assistant Professor, Mechanical Engineering Dept., MIT.

"Progress Report—Ceramic Cutting Tools Applied to Production Jobs" (#22)—J. F. Allen, Factory Manager, Cameron Iron Works, Inc.

10:00 a.m., Grecian Room, Shamrock-Hilton Hotel

Plastic Tooling Symposium

"What Are Plastics?" (#29)—V. V. Lindgren, Technical Director, Plastics and Resins Div., American Cyanamid Co.

"What Properties Are Available in Plastics" (#30)—Elliot N. Dorman, Assistant Technical Sales Manager, Plastics Div., Ciba Co., Inc.

1:00 p.m., Emerald Room

Ceramic Tool Symposium

"Analysis of Variables in Ceramic Tool Cutting" (#23)—Donald R. Kibbey, Instructor, Dept. of Industrial Engineering, Ohio State University.

"Industrial Application of Ceramic Tools" (#24)—Alfred O. Haeme, Tool Superintendent; and Robert T. Hook, Chief Metallurgist, Warner & Swasey Co.

Industrial tours scheduled for Tuesday, March 26, are: Tour #3—Mission Mfg. Co.; Tour #5—Schlumberger Well Surveying Corp.; and Tours #4 and #6—Hughes Tool Co.

Arrangements for these tours can be made on the preregistration blank on page 156. Buses will depart from the Shamrock-Hilton Hotel at 8:30 a.m. for the Mission Mfg. Co.; at 1:15 p.m. for Schlumberger Corp.; and at both 8:30 a.m. and 2:15 p.m. for the two Hughes Tool Co. tours.

March 26

1:30 p.m., Grecian Room, Shamrock-Hilton Hotel

Plastic Tooling Symposium

"The History of Plastic Tooling" (#31)—Appy Juras, Consultant, Bakelite Co., Div. of Union Carbide and Carbon Corp.

"The Fabrication of Plastic Tools" (#32)—Lloyd J. Oye, Marketing Director, Rezolin, Inc.

8 p.m., Emerald Room, Shamrock-Hilton Hotel

Ceramic Tool Symposium

Panel: *Ceramic Tools in Service*

"Experimental Machining with Ceramics" (#26)—Wallace B. Kennedy, Chief, Experimental Machining Branch, Rodman Laboratory, Watertown Arsenal.

"Ceramic Tools—The Challenge of Physical Properties" (#27)—E. W. Engle, Technical Director, Vascoloy-Ramet Corp.

"Ceramic Machining Development" (#28)—Norman Zlatin, Consultant, Wright Aeronautical Div., Curtiss-Wright Corp.

"Cemented Oxide Cutting Tools in Service" (#25)—E. J. Weller, Manager, Carbide Products Design Engineering, Metallurgical Products Dept., General Electric Co.

8:30 p.m., Grecian Room, Shamrock-Hilton Hotel

Registration Benefits to the Tool Engineer in Industry

"The 'Why' of Registration and the Benefits Accruing to Those Affected" (#1)—William M. Andrews, Partner, Consulting Engineers, Lockwood, Andrews & Newman.

"Registration—Industry's Point of View" (#2)—C. Y. Thomas, Vice President, Spencer Chemical Co.

First Eli Whitney Annual Memorial Lecture

Established this year in commemoration of Eli Whitney, the founder of American mass-production methods, the first Annual Eli Whitney Memorial Lecture will honor Louis F. Polk, vice president of Bendix Aviation Corp. and president of the Bendix Sheffield Div. in Dayton, Ohio. Mr. Polk has chosen our country's "Heritage and Growing Abundance" as the topic for this first lecture in the annual series, scheduled for 4 p.m. Tuesday, March 26, in the Emerald Room of the Shamrock-Hilton.

Eli Whitney, known widely for his invention of the cotton gin, is responsible for the more significant contribution to modern mass-production methods, the adoption of standardized, interchangeable parts. He accomplished the manufacture of 10,000 guns contracted for by the government in an unbelievably short time through the use of his standardization short cut.

Mr. Polk, following in Mr. Whitney's footsteps, has tirelessly promoted industrial standards. He was responsible for his company's establishment of the Eli Whitney Metrology Laboratory, which provides industry and government with precise measurement and inspection services, using precision standards of light wave accuracy.

Louis F. Polk

timetable for

WEDNESDAY

9 a.m., Shamrock Room, Shamrock-Hilton Hotel

Standards and the Tool Engineer

"Standardization and the Legal Eagles" (#41)—S. David Hoffman, LL.B, Head, Electrical Engineering Dept., American Standards Assn.

"Conception and Development of JIC Standards" (#42)—John Q. Holmes, Director, Production Engineering Section, General Motors Technical Center.

9:30 a.m., Emerald Room, Shamrock-Hilton Hotel

Management and the Tool Engineer

"Labor Control Experience in Aircraft Repair" (#3)—Herbert R. Belcher, Consultant, Ernst & Ernst.

"Some Economic Aspects of Machine Tool Selection" (#4)—S. E. Scharff, District Supervisor, Industrial Engineering, Ernst & Ernst.

10 a.m., Grecian Room, Shamrock-Hilton Hotel

Plastic Tool Symposium

"Tool Applications of Plastic Materials" (#33)—Lewis F. Bogart, Sales Engineer, The Marblette Corp.

"What Are the Known Limitations of Plastic Tools" (#34)—William Weaver, President, Modern Pattern & Plastics, Inc.

1 p.m., Grecian Room, Shamrock-Hilton Hotel

Plastic Tooling Symposium

"Can Plastic Tools Be Repaired and Modified?" (#35)—George M. Rice, Director of Sales and Advertising, Ren Plastics, Inc.

"Control of Physical Properties" (#36)—John Delmonte, General Manager, Furane Plastics, Inc.

Industrial tours scheduled for Wednesday, March 27, are Tour #7—Cameron Iron Works, Inc.; Tour #9—W-K-M Mfg. Co.; and Tours #8 and #10—Hughes Tool Co.

Arrangements for these tours can be made on the preregistration blank on page 156. Buses will depart from the Shamrock-Hilton Hotel at 8:30 a.m. for the Cameron Iron Works and the first Hughes Tool Co. tour; at 1:15 p.m. for W-K-M Mfg. Co.; and at 2:15 for the second Hughes Tool Co. tour.

March 27

1:30 p.m., Shamrock Room, Shamrock-Hilton Hotel

Stresses and the Tool Engineer

"Residual Stresses of Machining Operations" (#9)—Erik K. Henriksen, Senior Tool Engineer, Manufacturing Research and Development Section of Tooling, Convair, a division of General Dynamics Corp.

"Stress and High Temperature in grinding" (#10)—John A. Harrington, Chief Engineer, Grinder Div., The DoAll Co.

4 p.m., Emerald Room, Shamrock-Hilton Hotel

Engineering behind an Earth Satellite Launching

"Project Vanguard—Launching the Man-Made Moon" (#5)—Mahlon A. Winter, Manufacturing Manager, Project Vanguard, The Martin Co.

"Tool Engineering for Project Vanguard" (#6)—Raymond G. Sipe, Tool Project Engineer, Project Vanguard, The Martin Co.

8 p.m., Emerald Room, Shamrock-Hilton Hotel

Plastic Tooling Symposium

Panel: *Plastic Tools in Service*

"Repair and Modification of Plastic Tools" (#37)—Benjamin Sokol, Supervisor, Nonmetallics Section, Manufacturing Research and Process Dept., Republic Aviation Corp.

"Plastic Tooling for Small Parts:" (#38)—Walter J. Arrufat, Associate Engineer, Tool Engineering Dept., International Business Machines Corp.

"Experiences with Plastic Tooling in the Stamping Plant" (#39)—Edward Ruddiman, Supervisor in charge of progressive die design and special assignments, Tool and Die Design Dept., Ford Motor Co.

"Polyamide Resin Alloys in Practical Applications" (#40)—W. Robert Price, Project Manager, Plastics and Resins Commercial Chemical Development, Chemical Div., General Mills, Inc.

REGIONAL EDUCATORS CONFERENCE

The comparative roles played by colleges, technical schools, and industrial training programs will be the subject of the Regional Educators Conference to be held Wednesday, March 27 at 12:30 p.m. in the Western Room of the Shamrock-Hilton Hotel. Presented by the ASTE National Education Committee, the luncheon meeting can be attended by advance reservation only.

General chairman of the program will be Frederick Preator, head of the Tool Engineering Department at Utah State Agricultural College.

Participants in the panel discussion and their topics are: "University Training in Tool and Production Engineering" by Kenneth J. Trigger, professor in the Department of Mechanical Engineering, University of Illinois.

"Technical Institute Training in Tool and Production Engineering," by Albert V. Payne, president of Mohawk Valley Technical Institute.

"Industry Training in Tool and Production Engineering" by Oliver S. Hulley, education consultant with the General Electric Company.

THURSDAY
the last roundup

Spurs and chaps will be the order of the day for enjoying a final glimpse of Texas at its natural best at the rodeo and barbecue Thursday.

Buses will carry hungry convention-goers to the H & H Ranch where barbecued beef and ribs will be served at noon, with western entertainment.

At 2 p.m., clowns, bronc busters and all the other rodeo activities will fill the afternoon with fun, thrills, and surprises, Texas style.

Transportation to the rodeo and barbecue is $1.50. Barbecue fare costs $3.00 for the grownups, while youngsters under 12 have free space in the chow line. Reservation for these events can be made by using the registration blank below.

Preregistration Form
Silver Anniversary Meeting

☐ Member, Chapter No.———
☐ Non-member

MAIL TO: **AMERICAN SOCIETY OF TOOL ENGINEERS**
25th Annual Meeting
Preregistration Department
10700 Puritan Ave., Detroit 38, Mich.

I wish to preregister for ASTE's Silver Anniversary Meeting. My check (or money order) in the amount of $..... is enclosed covering items indicated below.

[Note: When registering for others, include their names and addresses on an attached sheet.]

No.	Item	Price	Total
	Convention Registration Fee	$2.00	
	Honor Awards Dinner	7.00	
	Silver Anniversary Social Hour	2.00	
	Silver Anniversary Dinner	8.00	
	Plant Tours ($1.00 each) Circle Tour No. 1 2 3 4 5 6 7 8 9 10	1.00	
	Rodeo and Barbecue (transportation not included)	3.00	
	Rodeo and Barbecue for children under 12 years (transportation not included)	no charge	
	Rodeo and Barbecue Transportation	1.50	
	Silver Anniversary Collected Papers* (includes all symposia papers)	5.00†	
	Plastic Symposium Papers*	3.00†	
	Ceramic Symposium Papers*	3.00†	
		Total Remittance	

*Orders to be filled by April 1, 1957.
†Prices shown include 50% discount to members. Full price is charged to nonmembers.

MAIL TO:

Name .....

Mailing Address .....

.....

Note: Hotel room reservations should be sent directly to Shamrock-Hilton Hotel, Houston 1, Texas.

ASTE
25
years
young
1932 – 51
PRESIDENT
SIEGEL
PRESIDENT
McMILLEN
FIRST V. P.
SMILA
FIRST V. P.
COLLINS
SECRETARY
SARGENT
SECRETARY
MORELAND

the early 30's

1932

Nazi plot

1934

Dynamic and 37,000-strong, the American Society of Tool Engineers is celebrating its 25th birthday.

Making history by providing man with the means for realizing progress, the Society is furthering the purpose as set out by its founders just 25 years ago:

This Society shall be an organized and functioning institution for the advancement of scientific knowledge in the field of tool engineering: To provide the means of applying such knowledge in practice and education; to promote within said field, and none other, and through its members engage in research, writing, publishing and dissemination of such knowledge. If there should be any net earnings from any activities aforesaid, the same shall accrue solely to said institution and no part shall inure to any member or individual.

In the first issue of THE TOOL ENGINEER magazine, which was then called the ASTE Journal, O. B. Jones, president of the Detroit College of Applied Science, summed up the need for a society:

"The formation of the American Society of Tool Engineers was just as inevitable as the formation of the American Colonies into a self-governing body. In both cases a certain chain of events resulted in a condition which stagnated growth. In the case of the Colonies, high taxes and no voice in the government brought about an intolerable situation. In the case of the tool engineers, the lack of a central body coordinating the actions of scattered individuals and groups, resulted in duplication of effort which was wasteful and contrary to the very religion of a tool engineer, which may be summed up in one word—'efficiency.'"

TENOR of the times

Every man who attended the founding meeting of the Society gave his enthusiastic consent and worked diligently to perfect the organization. Each worked unselfishly and set aside any desire for self advertising, thinking only of the successful outcome of the organization. This spirit was characteristic of the actions of all the men who devoted themselves unselfishly to making the new organization's success assured.

This farsighted group of rugged individuals was not daunted by the foreboding background that the national and international scenes were forming at the time of its inception.

Time of Uncertainty

Thus, in 1932, when industry and business were almost helpless, the year that was the lowest point of the depression, with unemployment the highest in history, ASTE was conceived. Almost anybody would have agreed that this was not the time to start anything new. Uncertainty—lack of planning—typified the country at that time. The founders believed that recovery would bring with it a revision in industrial economics. The old order, complete individualism in industry was passing. Industry, more and more, would have to sink or swim on its ability to produce better products more efficiently. These forward-looking men saw that recovery would bring with it a large share of responsibility for the men who were immediately concerned with the problems of production tools, methods, processes, and equipment.

It was this small nucleus of men, the founders of the Society, who christened a certain key group of men in industry with the all-embracing name of "tool engineer."

1934's International Scene Is One of Unrest

As ASTE was taking shape, the national scene was ever-changing, exerting motivating forces upon men of 1934.

Outstanding international events were taking place. A few months short of 1934, France, Great Britain, Germany and Italy signed a ten-year Peace Pact. In June a plot by Nazi leaders to disperse the rule of Adolph Hitler was discovered in Germany, and many suicides and executions followed its discovery.

Nazi Plot

A month later, the Nazis in Vienna seized the Austrian government and killed Chancellor Dollfuss. The army recaptured control, but the ultimate fate of Austria was accelerated by this event. Following the death of President von Hindenburg, Hitler as Leader-Chancellor took over complete control of the German government.

In Spain a general strike, fomented by socialist and communist leaders, resulted in a revolution, and the first of the actual warfare broke out in Europe with the shelling of Barcelona. Later in the year, Italy began the conquest of Ethiopia, and finally the futility of the League of Nations was proven when all economic and peaceful steps possible were taken against the aggressor, but failed to affect the final outcome.

Normal diplomatic relationships were renewed between Soviet Russia and the United States. In Asia, the Sino-Japanese incidents had already passed the point where they could be classed as mere local disturbances, but the Philippines were granted their independence.

Bank Holidays

1934's unusual history in international and national affairs provided an ever-changing background for the Society, although the Society at that time was purely local. In this era the "bank holidays" came into being; throughout the country the general feeling was one of greater respect for law and order with the enforcement of the 21st amendment. Most of the gangsters of this time, such as John Dillinger and Clyde Barrow, ended their careers in 1934. The first of the large-scale conservation measures were attempted as drought and dust storms swept the middle west. Men with courage and determination indeed were able to look ahead beyond the backdrop of events into a brighter future.

Silver Anniversary Scrapbook

Meeting on January 29 1932

From a small meeting held on the second floor of the Detroit College of Applied Science on January 29, 1932, grew the formal organization of the American Society of Tool Engineers. At the invitation of O. B. Jones, who had been associated with tool engineers for several years, a small group of production men from Detroit's automobile plants met to discuss the formation of a tool engineering society. "Society of Tool Engineers" was adopted as the official name of the new organization; an incorporation committee was appointed; and a five-member board of directors was created to draw up the first set of bylaws.

The group, including Frank E. Shailor, Guy E. Swartz, Frank H. Hartlep, Otto Poelke, Ford Lamb and O. B. Jones, felt that men who knew the funda-

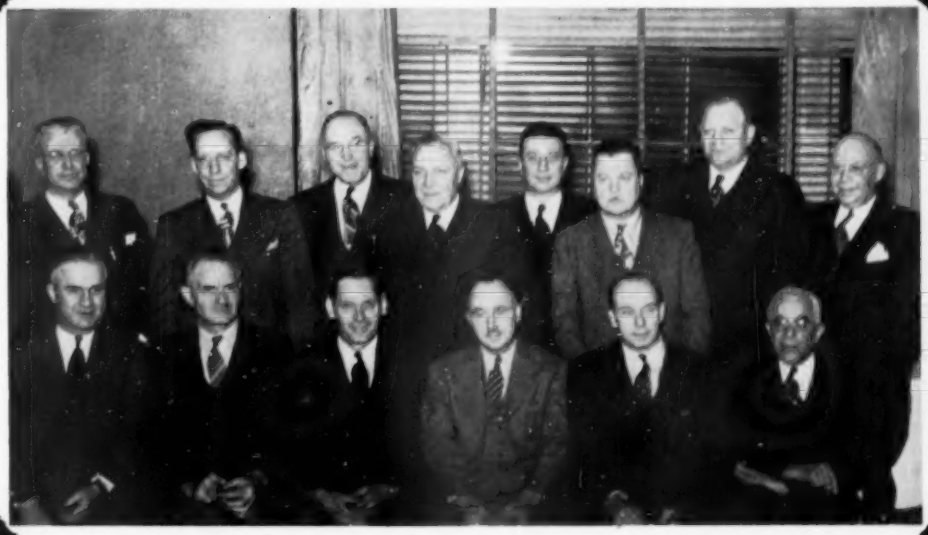
mentals of production processes weren't getting enough recognition, and that an organized technical society was needed to serve the purpose of educating people to appreciate the importance of the tool engineer's position in the economy. They decided to form an organization that would enable them to gather and exchange information that was professionally important to all, and that would increase the recognition of tool engineers.

Siegel Elected First President, March 23, 1932

It was agreed to spread the idea of a society by word of mouth among carefully picked men on a supervisory level. This resulted in 33 men gathering at a "Founders' Meeting," and for several years the Society had 33 directors, the original group being re-elected each year. Although the core of the Society was formed by men on a supervisory level, the definition of a tool engineer was broad enough to include everyone from professors to tool and die designers. Experience was the criterion, and salesmen were welcome if they qualified in this respect.

At the first formal banquet and meeting officers were elected: president, J. A. Siegel; first vice president, W. H. Smila; second vice president, E. J. Ruggles; secretary, A. M. Sargent; treasurer, William Fors. Shortly thereafter, the first technical session was held at a meeting at which L. A. Danse, chief metallurgist for Cadillac Motor Car Co., discussed design and development of tools and dies for forged connecting rods.

In this year the Society emblem was designed and a theme song written by J. A. Siegel was sung



At one of the Society's early Board of Directors meetings are shown, standing, left: Edward Rutt, A. M. Sargent, Walter Wagner, Peter Horn, Edward Lee, Cecil Buckner, Edward Beyma, and Earl Ruggles. Seated from left are: Joseph Siegel, Fred Hoffman, W. L. Newton, Raymond H. Farmer, Bill Fors, and E. R. Deluiz.

The Society's first annual picnic, June 24, 1933, drew a large crowd, including wives, children and friends of the members.

with great gusto by members and friends at the first annual dinner at Detroit.

On with the ASTE
We're engineers who answer the call
To tool the jobs both great and small,
Designing machinery and tools for the nation,
With simplified practice and standardization.
We have master mechanics and chief tool designers
And sales engineers with all their data in binders.
Our meetings instructive have proven productive
SO ON WITH THE ASTE.

ASTE Journal is Published in 24 Pages, May, 1932.

Forerunner of THE TOOL ENGINEER magazine, the ASTE Journal was published under the direction of Ford R. Lamb, chairman of the publications committee, to keep the members advised of all Society happenings and other pertinent events.

This first 24-page issue contained news, technical articles and 7½ pages of advertising.

"In this initial issue of the Society's monthly journal, we are placing ourselves before the public . . . ," said President Siegel in a message to all ASTE members. "The growth of our Society has been so phenomenal, considering its short period of existence, that we should like to spread its story to the four corners, but let us not be unmindful of the fact that greatness in number alone will not make a great organization. As our many members were incorporated into one society, also must we incorporate our ideas into activities, and that moulds history.

"The possibilities of our Society are unlimited, as the field for subject matter and thought is broad, but our accomplishments will be only that proven effort which we can show for the problems we have completed . . . ."

Today THE TOOL ENGINEER receives world-wide circulation as a leading metalworking magazine.

Aste Scrapbook

Speakers Club Formed and First Public Relations Counsel Appointed

In 1933, William H. Smila became president. Realizing the need for good public relations, the members appointed a public relations counsel.

In addition, a Speakers Club came into being when W. H. Smila conceived the idea in order to make polished speakers out of the unpracticed tool

Recognition from industry came about when the Society sponsored a meeting of the Machine Tool Congress that was held in conjunction with the National Machine Tool Builders' Association.

MODERNIZE FOR PROFIT

MACHINE TOOL SHOW NEWS

THE MASTER TOOLS OF INDUSTRY

VOL. I. NO. 3

CLEVELAND, O.

AUGUST 15, 1935

1935 EXPOSITION OPENS SEPT. 11 IN CLEVELAND'S VAST AUDITORIUM

A. S. T. E. Delegation Sailing to Exposition

1200 Charter Boat for Trip to 1935 Cleveland Show

The American Society of Tool Engineers has chartered the lake-steamer "Greater Detroit" to take about 1,200 members of the Society across Lake Erie to the 1935 Machine Tool Show. The boat will leave the foot of Wayne Street in Detroit on the evening of Thursday, Sept. 12, and arrive in Cleveland the following morning, Sept. 13, which has been designated A. S. T. E. Day in their honor at the Exposition.

In order to facilitate the attendance of so large a group, the members of the Society who go to Cleveland on the "Greater Detroit" will be registered for the Show en route and given their badges on the boat so that no further registration will be necessary at the Public Hall upon arrival.

During the evening of Sept. 13, the Society will have a banquet with professional entertainment preceding their technical session at the Hotel Statler. Members of all engineering societies are invited to the banquet as far as the tickets will go. The capacity of the Hotel Statler for the dinner is approximately 1,200.

Other organizations are making special arrangements to attend the 1935 Machine Tool Show. The Philadelphia Machinery Distributors, in cooperation with the Pennsylvania Railroad, will run a special air-conditioned train to Cleveland. The train will be parked near the auditorium for three full days during the height of the exposition and will provide every convenience for use as hotel and club, including telephone service and dining car accommodations. The Philadelphia Machinery Special will leave Philadelphia at 9:10 p. m. Eastern standard time Sept. 16 and arrive in Cleveland at 8:05 a. m. the following morning. On the return trip, the train will leave Cleveland at 8:25 p. m. Sept. 19 and arrive in Philadelphia at 7:05 a. m. the following day.

One industrial company has chartered two Pullman cars to take a group of its shop men to the Show. Other companies are sending their important executives, production and mechanical superintendents and foremen to the show in relays, and hundreds of other organizations are sending men to observe the "World's Greatest Machine Shop In Action," and it is certain that transportation companies will handle record crowds during the 1935 Machine Tool Show.

Show to Be Open Daily From 9 A.M. to 6 P.M.

The 1935 Machine Tool Show will be open daily between the hours of 9 a. m. and 6 p.m. from Wednesday, Sept. 11, to Saturday, Sept. 21, inclusive, with the exception of Sunday, Sept. 15, when it will remain closed for the day. Cleveland operates on Eastern Standard Time rather than Daylight Saving Time, a point visitors from both the East and Middle West may want to note in their schedules.

Railroad Day

The Exposition Committee of the 1935 Machine Tool Show has designated Friday, Sept. 20, as "Railroad Day" at the exposition in honor of the many railroad officials and maintenance men who plan to attend. Several exhibitors will have on hand that day cut-parts on which will be demonstrated the operation of modern machine tools in order that the visitors may see them in action on equipment and parts they are familiar with. Railroad Day is one of many special days at the exposition.

30,000 Visitors Will Attend Presentation of Modern Tools; Show to Continue for 10 Days

MORE than 30,000 persons from every state in the Union and at least a score of foreign countries will converge on Cleveland from September 11 to 21 for the greatest event in the modern history of the mechanical world—the 1935 Machine Tool Show, the largest industrial exposition ever held in the United States. The visitors will be responsible mechanical executives, shop superintendents, works managers, and thousands of important general management executives, bankers, financiers, engineers, government officials, educators and students, to each of whom the Show has a special significance.

A widespread foreign interest in the Show is indicated by reports received at the offices of the National Machine Tool Builders' Association, sponsoring organization of the exposition. Representation is coming particularly from England, France, Germany, Italy, Japan, Russia and Czechoslovakia.

SCENE OF 1935 MACHINE TOOL SHOW

View of the Cleveland Municipal Auditorium, one of the largest public halls in the country, which will be the scene of the 1935 Machine Tool Show. Lowering the the shore of Lake Erie, the Auditorium and connecting Exposition Hall have a total exhibit space of nearly five and one-half acres, all of which will be required to accommodate the hundreds of exhibits of modern machine tools and accessories.

Record Crowds Expected

Arrangements made by the special Hotel Bureau set up in Cleveland to facilitate housing arrangements for visitors establish definitely that Cleveland's excellent hotel system will successfully handle the record crowds. Last minute arrivals will be taken care of. Everyone who can fix a date for his arrival is making reservations in advance, however, the Bureau states. Its offices are Room 1604, Terminal Tower, Cleveland.

Every modern method of transportation will share in bringing the 30,000 visitors to the Machine Tool Show. A specially chartered steamship will carry 1,200 of them from Detroit. The Philadelphia Machinery Distributors, in co-operation with the Pennsylvania Railroad, will run a special train which will stay in Cleveland for three full days as its passengers' own hotel and club. Aircraft will bring in their quota, with the Show within five hours flying time of all the Eastern and Middle Western industrial cities. All the railroads into Cleveland already have arranged for increased passenger equipment. "Five thousand persons, at least, will come by auto," say the traffic police chiefs of the city, "and we'll be ready to make them glad they've come!"

Mecca for World

The Machine Tool Show is the whole world's mecca for everyone whose work is concerned directly or indirectly with the basic tools that make possible better products at lower cost and thus put ever-increasing goods and services at the disposal of more people.

The Show itself, the first since the beginning of the depression, is a review of America's mechanical preparedness. It will disclose results of six years of intensified effort to improve the efficiency and accuracy of machine tools in order that manufacturing production of all types may be faster, more precise and less expensive.

(Continued on Page Two)

The first annual convention dinner was held at the Statler Hotel in Detroit, March 11, 1938.

engineers. It met with great success, and the hesitantly speaking engineers were turned into accomplished lecturers.

This club was formed and existed for several seasons with many officers and members receiving valuable training during its existence. By this time the Society had become the "American Society of Tool Engineers."

Technical meeting growth and development characterized '34. The journal became THE TOOL ENGINEER and the first data sheets were prepared in accordance with ASTE specifications by The Cincinnati Milling Machine Co. President T. B. Carpenter in this third year of Society progress said, "We made mistakes along the way, but tried to acknowledge them, pointing out the pitfalls to those who were to follow."

At this time in ASTE's history, O. B. Jones in his editorial "Who Is a Tool Engineer?" predicted:

Aste Scrapbook

"Starting a half-century ago, a peculiar type of mechanical genius began pulling itself away from traditional and legendary engineering and began to develop ideas of interchangeable manufacture. Their ideals are far from being attained. Tremendous strides will be made by them in the coming decade, making us ashamed of our 1935 crude manufacturing methods . . . the tool engineer, regardless of the title under which he has labored in the past, is the one who has done the actual tool or production engineering which, because of its effect upon our everyday mode of living, causes the average citizen to have faith that, if he has the 'down payment,' any luxury of which he might dream can be his."

Although still a Detroit organization, by the middle of '35, the nucleus of 33 had grown to 100 and then doubled and redoubled again.

Word of the Society's doing had been carried into other industrial centers by visitors to the motor city who had attended one or two of the meetings of the Detroit group and recognized that here at last was an organization that really fitted the needs of a tool engineer. Designed for him and him alone, the organization was being run by its members for the maximum benefit of all.

These visitors got together with tool engineers in their own towns and decided that their problems were similar to those of the Detroit group, that they had the same need for, and could derive the same benefits from an organization such as Detroit

boasted. Applications for membership followed and in October of 1935 the first outside chapter was chartered in Racine, Wisconsin, a milestone in the growth of a society whose success obviously was not to be denied.

This was a year, under the presidency of Robert M. Lippard, of learning to serve industry and the membership.

A special all-expense trip was arranged for ASTE members including round-trip transportation from Detroit to Cleveland on the S. S. Greater Detroit to the Third Machine Tool Congress, sponsored by ASTE, and held in conjunction with the National Machine Tool Builders Association.

At the Machine Tool Congress, ASTE presented literature concerning its own aims and functions, and handed out membership blanks. Keen interest was shown by people from all over the country in this new organization.

Principal speakers of ASTE's assigned night at the convention were Past President W. H. Smila, who spoke of the data sheet program which was being developed and A. H. d'Arcambal, who was destined to be president of the Society, who spoke on "Trend of the Development of Cutting Tools."

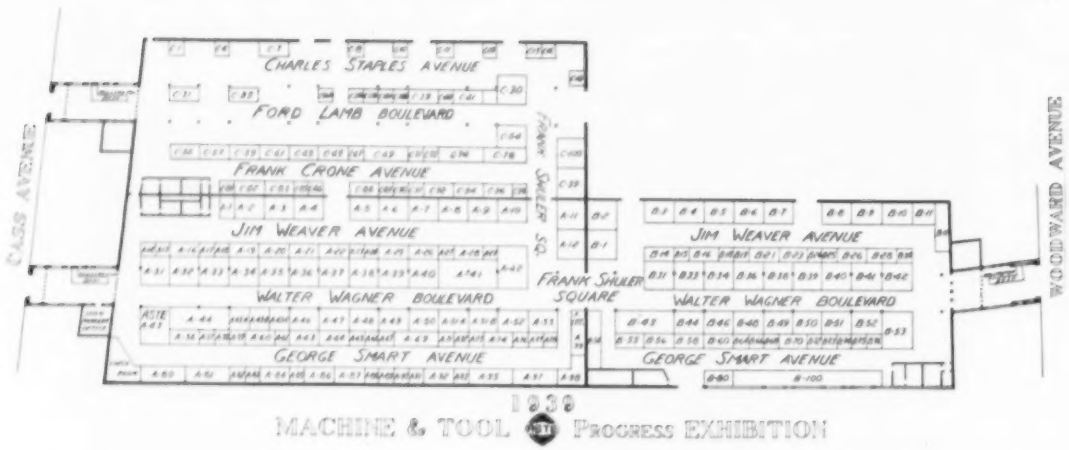
Chapters in Cleveland, Milwaukee, Chicago, Bridgeport, and Hartford received charters. By the end of 1936, under Ford Lamb's presidency, there were seven chapters when 1935 could boast of only two. Upon retiring from the presidency, Ford R. Lamb assumed the office of executive secretary of ASTE.

Two types of membership were now available to tool engineers in industry: senior and junior. ASTE recognized the need for offering Society services to those who would some day become full-fledged tool engineers by having a student grade.

Astounding as was the growth in 1936, the following year eclipsed it. In that year, seven new chapters were chartered and membership more than doubled. The American Society of Tool Engineers had become a national organization.

Directors of the Society, at their October, 1937 meeting, under the presidency of Frank A. Shuler, reviewed this startling growth, unequaled by any other technical organization, and decided that the time had come for a national convention to be held in Detroit. Educational exhibitions were to be included where members could learn at first hand all about the latest developments in machines, tools,

A Board of Directors meeting on March 10, 1938, is pictured here.



The floor plan of ASTE's 1939 exhibition is shown here with "streets" varying from Charles Staples Avenue to Walter Wagner Boulevard.

processes and production equipment. With a door count of 24,000 persons at the 162-exhibit show, this Machine and Tool Progress Exposition demonstrated the professional ability of the Society. It was well managed and extremely successful financially.

Astounding Growth

In conjunction with the 1938 show, a national ASTE membership meeting was held, at which Walter F. Wagner was elected president. Membership in the Society nearly doubled over the previous year, and a record number of nine chapters was added.

A fact-finding committee, organized by ASTE and composed of outstanding industrial executives, writers and educators, studied the effect of mechanical improvements in industry and labor. On their findings, which were widely published, ASTE President Wagner declared "Tool engineers are pioneers on the frontier of economic development."

In 1939, many national ASTE committees were organized to accomplish further objectives; emphasis was placed by the membership committee on quality rather than quantity of members. It was believed that a technical society best serves the needs of its membership when the members meet required qualifications.

Over 35,000 people attended the 1939 Machine and Tool Progress Exposition to see the 250 exhibits. "Machines Make Work" was the theme of the second extremely successful exhibition and ASTE annual meeting.

In '41 and '43 two more such exhibitions were held, one in Detroit and one in Milwaukee, demonstrating ASTE's ability to create good industrial expositions.

Individual chapter growth characterized A. H. d'Arcambal's year. As president, he visited many of the chapters during the year to deliver technical addresses on a wide variety of subjects. The annual meeting was held in New York and, for the first time, ladies' activities were a feature of the program.

In 1941, President Frank W. Curtis stressed that good meetings are the backbone of a chapter. With the advent of the tooling program for World War II began the awakening of the nation and the entire world to the things the tool engineer knows best, mass production of goods.

World War II put the tool engineers in America to the test. In many chapter cities the ASTE Tool Engineering Talent Survey named persons who helped staff war production advisory councils that assisted war plants in making products unfamiliar to their type of manufacture.

Interest in production know-how was unprecedented. Many ASTE members taught in the Engineer-Science-Management War Training program of the government. ASTE helped publish and distribute war training material—particularly the New York State Education Department monographs.

Aste Scrapbook

Early in 1942, William S. Knudsen, former president of General Motors Corp., who had been awarded the coveted Distinguished Service Medal and Oak Leaf Cluster for directing the War Department's mass production mobilization, declared in a tribute and challenge to ASTE:

"The problem ahead of you is the Number One problem facing American industry today. It will require all the ingenuity, all the resourcefulness, all the initiative you have shown in the past. These qualities have made the American Society of Tool Engineers a key organization in American production. You know the job ahead of you. It is not for me to tell you how to do it. It is for all of us here in Washington to help carry it out. You have my promise that we will do so. Every new machine tool you can convert will mean extra power on the firing line. That is the power that will win."

The jovial group of presidents shown here from left are: T. B. Carpenter, R. M. Lippard, W. F. Wagner, O. W. Winter, J. A. Siegel, and J. R. Weaver.

Shown after an executive committee meeting in 1941 are, front row from left: Frank Curtis, president 1941-'42; Ray Morris, president 1943-'44; back row, Frank R. Crone; Otto Winter, president 1942-'43; and Clyde L. Hause.

Engaging in a lively conversation at one of the early meetings in the Society's history are, from left: Brad Peirce, president 1947-'48; A. M. Sargent, president 1946-'47; William Stout, speaker, noted for his many inventions, some of which were in connection with all-metal aircraft; C. V. Briner, president in 1945-'46; and Thomas Orchard.

Under President Otto W. Winter groundwork was laid for the long-term program of installing tool engineering courses in colleges and universities. ASTE, in 1943, initiated the project of publishing a handbook for tool engineers. Ray H. Morris, president, created an organization progress committee to revise the constitution and bylaws.

After membership increased another 3,000, under the presidency of C. V. Briner, in '45, the new constitution and bylaws were adopted, making what is said to be one of the most democratic organizations among technical societies.

The "New Era Exposition" held in Cleveland during C. V. Briner's presidency drew record crowds. With the advent of the new procedures, A. M. Sargent, president in 1946, achieved closer harmony between chapters and headquarters.

In the postwar years the Society made great strides in technical growth and development.

In 1948, the year Irwin F. Holland became president, the "Tool Engineers' Industrial Exhibition" was held in Cleveland, followed in 1950 at Philadelphia, by "Cost-Cutting;" "Tooling for Security," Chicago, 1952; "Tooling for Competition," Philadelphia, 1954; the Los Angeles Western Industrial Exposition, 1955; and "Tooling for Tomorrow" in Chicago, 1956.

An important part was played in the Society's history by the Canadian chapters who have added immeasurably to ASTE, not only in making the Society of international scope, but also in contributing the Society's first Canadian president, R. B. Douglas, in 1949-50.

Today, with a membership of 37,000, ASTE stands as one of the country's foremost engineering societies. ASTE's roster now includes 145 chapters in the United States and Canada. More than 1400 technical speakers, panel discussions and plant tours are sponsored every year.

Tool engineers play a vital role in industry. With their aid, it is possible to bring prices of manufactured goods within the reach of all. America's standard of living, the highest anywhere, is constantly expanding as more people are able to get more things at lower cost . . . thanks in large part to the ingenuity and skill of tool engineers.

It is indeed a tribute to the farsightedness of the founders of the American Society of Tool Engineers that men and women of the tool engineering profession occupy such a position of honor.

Aste Scrapbook

Joseph A. Siegel
1932-33

William H. Smila
1933-34

T. Bert Carpenter
1934-35

Robert M. Lippard
1935-36

Ford R. Lamb
1936-37

Frank A. Shuler
1937-38

Walter F. Wagner
1938-39

James R. Weaver
1939-40

A. H. d'Arcambal
1940-41

Frank W. Curtis
1941-42

O. W. Winter
1942-43

Ray H. Morris
1943-44

Douglas D. Burnside
1944-45

Cletus V. Briner
1945-46

Albert M. Sargent
1946-47

our Aste presidents

W. B. Peirce
1947-48

I. F. Holland
1948-49

Robert B. Douglas
1949-50

H. L. Tigges
1950-51

J. J. Demuth
1951-52

Leslie B. Bellamy
1952-53

Roger F. Waindle
1953-54

Joseph P. Crosby
1954-55

Harry B. Osborn, Jr.
1955-56

H. C. McMillen
1956-57

tool engineering education *then and now*

By Robert E. McKee
chairman,
National Education Committee

The nerve center of any society lies in its educational activities. From the increase in size of ASTE's National Education Committee and the accelerated growth of its activities over the past years it is evident that the educational requirements, functions, and duties of the Society are well defined.

Growth in establishing tool engineering curricula at various engineering colleges and universities has been slow, but the message of the American Society of Tool Engineers has been carried to many colleges, universities, and high schools. Gradual acceptance of some of the fundamental concepts of tool engineering training has been observed, and it is noted that there are occasional additions in this type of education at various schools as postgraduate activity for engineers. One course in tool engineering with a bachelor of science degree is available at Utah State College.

Growth of educational activity in a technical society is a very healthy sign. In tracing the devel-

One of the primary aims of ASTE's education efforts is being realized as many colleges across the nation adopt training programs keyed specifically to the needs of production engineering.

opment of the National Education Committee, it may be seen that little formal effort was extended during the early life of the Society. However, with the origination in 1939 of this committee, with Herbert D. Hall as chairman, education played a vital part in the Society's growth.

Committee Broadens Scope

October, 1940, was the date of the appointment of an emergency defense training committee, with Mr. Otto Winter serving as chairman. This committee remained active during 1941 and 1942 and the original concept of national education committee activities was reinstated in 1942 and continued to 1948 under the chairmanship of Mr. Winter.

During 1942 to 1945 the record shows that considerable attention was given to book publications in the tool engineering field—an interest that has not slackened to the present day. It has been apparent through all these years that there have been far too few publications in the field of manufacturing.

Activities originating during the year of 1946 were: investigation of tool engineering research, scholarships, professional registration, college curricula, tool engineering literature, student and junior groups, apprentice groups, and visual education aids. Also during this period interest was originated in the tool engineering handbook because of the lack of data, standards, and information on this very important subject.

The first annual report written for this committee's activities was dated March, 1948, and among the wide selection of subjects discussed were: the Boston semiannual meeting for committee members and New England educators to discuss tool engineering education, consideration of 11 technical institutes and trade schools for committee approval by certification, book reviews, manufacturing technologists, tool design texts, student groups, apprenticeship, visual aid, chapter scholarships. It is evident by reviewing such a report that these many activities have carried to a certain degree through the several years of activity in our Society.

During the year 1948 - 1949 this committee was chairmanned by Professor Halsey Owen and in the committee report there was indicated interest in 5 student group affiliations with chapters. The original recommendation of scholarship awards was made to the Board of Directors during this period. This committee recommendation was for scholarships of five per year at $750 each.

During the years 1949, 1950, 1951, and 1952, Professor J. N. Edmondson served as chairman of this committee. Student groups, chapter education activities and awards, research fund activities, and data on tool engineering curricula were given considerable attention at this time. The recommendation of $1500 annual scholarships, five each at $300, was given to the Board of Directors and a survey

The student chapter program, right, initiated in 1953, is typified by this group of officers from the Utah State College student group. This college was the first to offer a bachelors degree in tool engineering.

Pictured below is the first tool and die design class initiated at chapter level by the Philadelphia chapter at Spring Garden Institute, 1941. Through ASTE's education program, courses have been made available for advanced specialized training of the tool engineer.

of the industry concerning personnel needs for a five to ten-year period was completed. During the last year of Professor Edmondson's chairmanship considerable attention was given to scholarships and intensive study of five-year tool engineering curricula. It was during this period that the first Regional Educators Conference was planned.

On-Campus Conferences Initiated

During 1952 to 1954, the program of this committee was under the chairmanship of A. R. Diamond. The activities that were highlighted during this time were: the initiation of on-campus conferences, chapter level activities, tool engineering curricula and option studies, development of courses of technical institute level, and scholarship awards of ten annually at $700 each. It was during this time that the change from the name ASTE Scholarship Award to ASTE National Education Award was effected. It might be interesting to note that the education activities of the Society, at this time, were governed by a six-man committee.

Through the education program, many courses have been made available for advanced specialized training of the tool engineer.

During the years 1954, 1955, 1956, and 1957, this committee underwent a considerable expansion in its size under the chairmanship of Professor R. E. McKee. At the beginning of this term Student Chapter No. 1 at the University of Michigan officially was chartered, by action of the Board of Directors, and provided a pattern for growth in this particular activity in our Society.

On-campus conferences were increased in number and extended from coast to coast in the country. The year 1954 to 1955 was highlighted by sponsorship of a technical session at the annual meeting on the west coast, a West Coast Regional Educators Conference, a survey of E.C.P.D. accredited engineering schools concerning the number of tool engineering courses and type of degrees offered in engineering, television program survey, change in the statement of International Education Awards to include two or three non-accredited engineering schools, and an increase in number of student chapters to six.

Survey of Engineering Graduates Made

In 1955—1956 a survey was made of alumni-engineering graduates of five engineering schools in the United States. This survey was intended to disclose the number of alumni of the years 1951 and 1952 engaged in various types of activity such as: manufacturing processes, product design, research, sales, administration, heat-power, maintenance, and others. The results of this survey were very enlightening to the committee and a subsequent survey was made of 1156 metalworking industries to determine the classifications of work indicated by the assignment of their 1952 graduates of mechanical and industrial engineering. This latter survey produced results that were most encouraging and gave considerable support to the alumni survey.

The record also shows that for this year, eight additional student chapters were added to the growing list of our Society family. Also, provision was made for the gratis distribution of THE TOOL ENGINEER to all E.C.P.D. accredited colleges and universities and chapter sponsorships of THE TOOL ENGINEER to the high school libraries in each of their areas.

By 1956—1957 the size of the committe had grown from an original number of five or six to its present size of 15 with the establishment of subcommittees as follows: college, university and management level; technical institute and junior college; high school and apprentice programs; chapter level and self-improvement activities.

In looking back over the growth of the Society, one can observe that many of the same ideas and ideals of the founders of our group are prevalent in our present-day activity. We are constantly striving to obtain some of the goals that have been established by many of the past academic and industrial members of this committee, and our Society has been able to establish and remain active on some of the problems that are prevalent in education for the manufacturing world.

Our Society must look ahead to the educational requirements of the future and extend an increased effort in the education of manufacturing personnel, whether it be engineers, technologists, apprentices, or individual members. The requirements of manufacturing knowledge and application will be much greater in the future than at any time in the past, if the production leadership of this country is to be retained in a world that has observed the effects of producibility and the resulting economy.

ASTE research fund *a service to industry*

Constantly available to an ever-widening industrial horizon are the services of ASTE's Research Fund Committee. The Research Fund's purpose—that of fostering research in the broad field of tool engineering—is accomplished in three ways: Projects are sponsored entirely from the Fund, projects are undertaken at the request of, and subsidized, at least in part, by an industrial group, and research workers are encouraged by the interest or monetary backing of ASTE.

Preceding the establishment of the Fund in 1951, a temporary committee under the chairmanship of A. M. Sargent studied the need for such a service. Their efforts, which have been extended by the Research Fund Committee, have made possible an activity that is unique in technical society operations.

The constitution provides that the Fund will be composed of from 5 to 15 men elected for life by the ASTE Board of Directors, the chairman being elected for a one-year term of office.

"Board criteria for judging a proposed research project have been established. To be acceptable a project should: (1) fall within the broad field of tool engineering, (2) avoid, insofar as practical, research more properly considered within the realm of other organizations, (3) involve research basic in nature but having practical objectives, (4) have the potential of producing results of interest to, or use by, a sizable group of tool engineers, advance the science of tool engineering, (5) result in a saving of strategic material or manpower, or provide some other economy of operation.

"It is also the aim of the Research Fund Committee to provide that the maximum practicable student training result from its projects."

The ASTE Research Fund has sponsored five projects and has a sixth under careful study. The first project, nearing completion, is a study of the possibility of establishing the temperature pattern or distribution in the workpiece during cutting.

The second project was a study of the properties of borides to determine if these materials were of lasting interest to tool engineers. This was followed by a comparison of the efficiency of mist applications of cutting fluids versus other methods of application. Resulting in a paper at the 24th Annual Meeting of the ASTE, this work will shortly be the basis for a Research Report.

Another project is the study of plastic tooling. The first contract of this project was placed at Purdue University and covers an investigation of accurate and dependable methods of measuring those properties of plastics that are of interest to tool engineers.

Probably the most ambitious project on which the Research Fund has embarked to date is its Metal-Cutting Research Project. A contract was placed with The John Crerar Library to bring the bibliography up to date, and also with Battelle Memorial Institute to study and evaluate the whole of metal-cutting literature.

The Research Fund is also carefully evaluating a long-range study of metal stamping.

Each project is supervised by a steering committee whose members are selected because of their knowledge of the subject and because their job requires that they have an interest in obtaining additional data.

In addition to stimulating research, the Committee serves the tool engineering profession by assisting in the dissemination of data, obtained during research.

In its short but dynamic history, ASTE's Research Fund has become a thoroughly recognized and respected activity of the ASTE.

Colonel L. S. Fletcher was appointed research fund director of the American Society of Tool Engineers in 1954. A graduate of West Point Military Academy, Colonel Fletcher also attended Rhode Island State College and Massachusetts Institute of Technology. He holds a bachelor of science degree in mechanical engineering.

Prior to joining ASTE, Col. Fletcher was technical director and president of Sam Tour & Company, Incorporated.

He is past chapter chairman of the Tri-Cities chapter and is now a member of the New York chapter of American Society of Metals. He is a registered professional engineer in New York State and is a member of the ASME, ASTM, AOA and Metal Science Club of New York.

ASTE's addresses *through the years*

Keeping step with the tremendous growth of the Society during the past twenty-five years, ASTE Headquarters has grown up, too. From its original lodgings in the basement tool shop of the first national secretary, Headquarters offices occupied increasingly larger quarters, until now they fill a modern block-long building at 10700 Puritan Avenue, Detroit.

Back in 1932, for lack of a better place, Society business was conducted and records kept in an office at 8316 Woodward Avenue in Detroit, the business address of the Society's then current secretary, A. M. Sargent. Since it was his responsibility as secretary, Mr. Sargent, along with some volunteer help, handled all the business at first.

After two years, an increase in Society ranks indicated a change was in order, and the books were moved into what was known as "the old church basement" at 31 Melbourne. Back in 1935, Society business took the full time of one girl to keep track of the 382 members of that year.

With the 1937-38 presidency of F. A. Shuler, during whose term ASTE membership doubled, the

first separate office was opened on Second Boulevard. During this period the retiring president, Ford R. Lamb, was appointed Executive Secretary, and paid a salary for his services at the office three days a week.

The Second Boulevard address proved also to be a temporary one and, in the course of another few months, something larger was in order for the housing of precious ASTE records and the handling of its business affairs. For, with a membership of over 2,000, Society business was getting to be big business.

The Boulevard Building

Thus in May of 1938, ASTE moved into its own office in the Boulevard Building, at 2567 West Grand Boulevard. The office had the gold letters ASTE on its door, and required the full-time services of both a man and a girl.

With each new member, each additional chapter chartered, and with every passing year, the work of headquarters personnel multiplied. Increased services to members, plans for more and more impressive machine tool exhibitions, and the initiation of many plans of action for the furthering of Society aims, all added to the load of paperwork that would normally be increased merely by the sheer explosion of its membership from a handful of men in 1932 to over 16,000 at the end of 1944.

On November first of that year, headquarters and staff were moved to the 16th floor of a newly finished wing in the Penobscot Building in downtown Detroit. "Situated in the heart of the financial, transportation, hotel, office supply, and printing districts," according to a contemporary article in THE TOOL ENGINEER, the building offered three daily mail deliveries, and 23 pickups by the post office three floors below headquarters. For the first time, the staff was completely departmentalized, with individual offices devoted to separate phases of ASTE activity. A greatly enlarged shipping and receiving room made it possible to assemble and distribute data sheets, a job previously performed by an outside contractor.

ASTE's national address remained "1666 Penobscot Building" for four years. Toward the end of the third year, it became obvious that the suite's 3,200 square feet of space would soon be completely inadequate, and President W. B. Peirce appointed a housing committee to study possible solutions. Appropriately enough, A. M. Sargent, who had shared his own offices with the infant organization back in 1932, was appointed head of the committee to investigate various plans for expansion. At a special meeting of the Board of Directors on May 22, 1943, his report revealed that building a new central office would be preferable to remodeling or continuing to rent.

As a result of his investigation, the Directors appropriated $160,000 for the site and construction

Half of the ground floor of this granite building at 5928 Second Boulevard was ASTE's home during the presidency of Frank Shuler in 1937-38.

Back in 1944-48, ASTE carried on its business in the Penobscot Building, sixteen stories above Detroit's city streets. For the first time the headquarters staff was completely departmentalized.

of a headquarters building and authorized the appointment of a Building Committee and a Special Finance Committee to follow through on the plans. At the meeting, building designs were revealed, and later, proposed sites were visited, resulting in the selection of a 224 x 100-foot tract on Puritan Avenue, which was at that time virgin land with respect to business buildings.

President I. F. Holland named Mr. Sargent chairman of the Building Committee, which would supervise the construction, and R. H. Morris as chairman of the Finance Committee. Among others on the Building Committee was H. E. Conrad who, as Executive Secretary, was familiar with future requirements of the national headquarters.

Ground was broken July first for the 12,000-square-foot cinder block building, and the contractor promised its completion in not more than 120 days. The Society's new home was planned with minimum upkeep, and maximum comfort and convenience in mind, and included a 30-ton ice capacity air-conditioning system, fluorescent lighting, and acoustical ceilings.

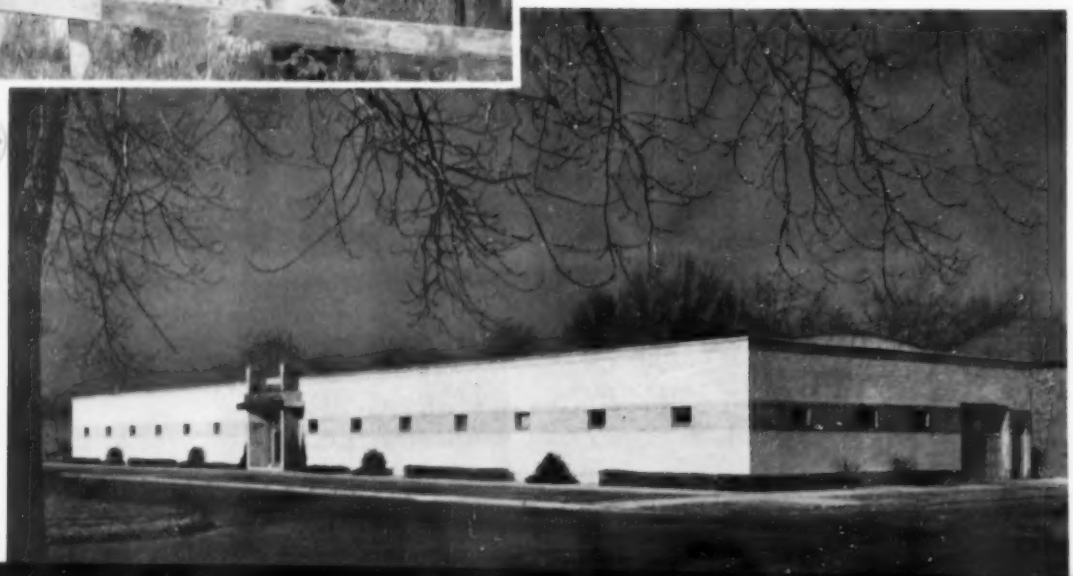
The move-in date was early in November. Construction proceeded according to schedule, while a flurry of activity in the Penobscot offices resulted in cataloguing and packing of office records and equipment in preparation for the move. Early files were indexed for preservation as Society archives.

At last the move was made, and ASTE had a home of its own. Planned with a built-in safety factor, the building was so constructed that if an emergency arose preventing the Society from maintaining it profitably, it could be sold for light manufacturing, and the initial outlay realized. This tremendous business venture justified itself, however, when all building bonds, subscribed to by ASTE members and chapters, were retired after one year.

Five years ago, membership was 23,000, compared with 37,000 today. Five years ago, chapters numbered 100, compared with 145 today. Five years ago, the Research Fund existed only in the minds of Society planners. Now it exists in reality, and its director and its business occupy space in the building. THE TOOL ENGINEER editorial and business staffs, the National Technical Publications Committee, Data Sheet Service, and many other services and departments have swallowed up all available space and the Headquarters building, once deemed more than adequate, is utilized down to the the answer. Perhaps another five years will see a last square inch.

The question at the last Semiannual Meeting was "Where do we grow from here?" The future holds newer, larger building, built further out from the now congested business areas. One thing alone is sure. As the Society grows, so grows its services and departments, and so will grow its Headquarters.

Shown at left is the Puritan Avenue site of the present Headquarters building as construction was begun in 1948.



ASTE's Headquarters as it appears today. The building, constructed in a record time of four months, covers a block-long area between Manor and Montevista.

the next 25 YEARS

Looking into the future is usually the job of the fortunetellers and crystal-ball gazers. Their foretelling, however, is about as dependable as that of the race-track tipster. It is, though, possible and necessary for any well-organized and successful institution to consider what the future may hold, and there are many sound and business-like methods of determining this with a fair degree of dependability.

Projecting or forecasting requires the assumptions of certain facts being stable over the entire period under consideration. These facts may be economic in nature or they may deal with management, personnel, product, facilities, etc.

In the case of the ASTE, many of the ordinary factors involved in forecasting do not necessarily apply. There is one factor, however, that dominates our situation. This is a moral factor and is called *desire*. Whatever our *desire* is—insofar as the destiny of ASTE for the next twenty-five years—that's what it will be. In other words, we can accomplish anything we want to if we honestly and sincerely *desire* to do so.

If we so *desire*, we can double, triple or quadruple our membership in the next twenty-five years. If we *desire* to do so, we can expand our services to members and industry. The prestige of the Society or of the individual member can be enhanced to any degree that is *desired*.

The stable factors involved in our forecasting are stated in our Constitution and are the purposes for which the Society was founded. These purposes as stated are:

To further the advancement of scientific knowledge in the field of tool engineering.

To provide the means and methods of applying such knowledge in practice and education.

To promote within said field and through its members engage in research, writing, publishing, and dissemination of such knowledge.

The extent to which these purposes are to be developed over the next twenty-five years becomes the goal which we *desire* to achieve.

Our product is the sum of the purposes for which the Society was founded. When we determine the basic elements of our product such as quantity, type and kind of material, finish, method of distribution, advertising and promotion media, and methods of merchandising then, and only then,

can we determine the facilities, the machinery and the processes that are necessary to proceed.

Top priority in the Society's responsibilities is its service to members in advancing scientific knowledge in the field of tool engineering. All of its other obligations come about automatically in the accomplishment of the foregoing.

During the next twenty-five years there will be a broadly expanded and intensified chapter program wherein members will be given an unprecedented opportunity to increase their knowledge of the science of tool engineering, as well as the opportunity for self-improvement in other personal attributes. The chapter program will be augmented by a finer and more complete service to the membership by the greater accomplishments in our publishing activities. THE TOOL ENGINEER magazine will continue its progressive program of improvement, bringing more and more scientific information to members. The Technical Paper program will mature into an inexhaustible source of technical data unequalled anywhere in the world. Part of this wealth of information will be contained in the Research Reports which are just now beginning to blossom forth. The Society's Technical Book publishing activity will create a wealth of information in one field which will be of inestimable value to engineers, industry and students.

Convention activities will grow to greater heights with the current technical sessions and exhibit features playing a far more important role in making the Society's contributions more effective in industry.

The challenge in the educational field is almost beyond comprehension and the Society will have its greatest opportunity during the next twenty-five years to make a really great contribution to the American way of life and the success of our free enterprise system.

To the individual tool engineer, the next twenty-five years will offer interesting and worthwhile opportunities, as well as real challenges to his talents and ingenuity. Scientific development during the next twenty-five years will create multiple problems wherein the tool engineer will of necessity be forced to exceed his accomplishments of present day developments. His objective of the future, like that of the past and present, will be—"A Better Life Through Creative Manufacturing."

Additional Candidates for Board Petitioned

The following men have been nominated by petition as candidates for the National Board of Directors. Their names should be considered along with those submitted in the Annual Nominating Committee's Report, appearing in THE TOOL ENGINEER for January.

EDMUND HOLLINGSWORTH, chairman of the National Program Committee, is president of Tools Inc. of Philadelphia. He has held various offices in the Philadelphia chapter, including those of chairman and delegate. He was chairman of the 1954 Philadelphia ASTE Exposition and co-chairman of the Carbide Seminar held at the University of Pennsylvania during the exposition. A graduate of Girard College, he attended New York University, is a member of AOA, and is president of his community's Civic Association.

FRANK EDWARD MENARD is president and consulting tool engineer of Frank Menard Mfg. Co., Redwood City, Calif., fabricators of small precision dies. A charter member of Santa Clara Valley chapter, he has served as chairman of the Constitution and By-laws Committee, the Membership Committee, Education Committee, Industry and Education Night Committee, and co-chairman of the On-Campus Conference Committee. He has also been vice chairman and chapter chairman, national delegate, and alternate. Currently chairman of the Santa Clara Valley Engineers Council, Mr. Menard has a rich teaching background. For several years instructor of fundamentals of tool engineering and advanced die design for the San Jose State College Extension Dept., he last year taught production tooling and advanced die design for the University of California, Berkeley.

CECIL E. CHAPMAN, a past chairman of the Calumet Area chapter, is superintendent of Rail Accessories Dept., Inland Steel Co. Active in his chapter's formation, he was its charter vice chairman, and is currently chairman of the Indiana Council of Chapters, embracing all state chapters and one in Louisville, Ky. Mr. Chapman was also active in the chartering of the local ASM chapter, and is a past chairman of this group. Member of the National Association of Foremen, and the Railroad Maintenance of Way Club of Chicago, he has also served on technical committees of the American Iron and Steel Institute and American Railway Engineering Association. With a background in metallurgy and tool engineering from the University of Wisconsin, Mr. Chapman has authored a number of technical papers.

aste

chapter news

Binghamton 182, 185
California State Polytech 185
Calumet Area 185
Columbus 184
Denver 182
Detroit 182, 184
Erie 181, 183
Fond du Lac 185
Golden Gate 185
Hamilton District 181, 185
Kalamazoo 181
Lehigh Valley 185
Little Rhody 182
Long Island 185
Los Angeles 181
Northern New Jersey 184
Paterson 185
Portland, Ore. 184
Santa Clara Valley 184
South Bend 181, 183
Springfield, Mass. 183
Tucson 181
Twin Cities 183
Western Reserve 184
Windsor 182

KALAMAZOO—Pictured at the speaker's table at the annual ladies night dinner are, left: Mrs. and Chairman C. A. Elzinga; Reverend Keith L. Hayes, speaker: Program Chairman and Mrs. Nathan Miller; First Vice Chairman and Mrs. Donald Nantz.
—Robert C. Frye

Permanent Magnets Subject of Erie Meeting

Arlo Israelson spoke to Erie chapter on the subject of permanent magnets. He discussed some of their uses and stated that to date 15,000 to 20,000 such applications have been discovered. Principal uses of magnets in automation are to hold transfer and control. Alnico, discovered by a Japanese, is one of the best-known magnetic materials. A new type of ceramic magnet, Mr. Israelson went on to discuss, can be demagnetized only by heating. A permanent magnet, if not abused, loses its strength at the rate of 1/10 percent per century.

—Leo B. Weiner

CHAPTER news and views

Chem Milling Talk At Los Angeles

One hundred seventy members and guests met at Scully's restaurant to hear George H. Fox, Jr., assistant sales manager of Chem Mill Div., Turco Products, Inc., give an address on "Chem Milling." This first meeting of 1957 also included a film by the U. S. Coast Guard, "Common Sense Afloat." The speaker was Commander A. M. Davidson, Public Information Office, United States Coast Guard *—Gene Grahn*

Tucson Discusses Oxide Cutting Tools

Tucson heard Edward Kibbitt of the Carborundum Company speak on "The Application of Oxide Cutting Tools." Mr. Kibbitt drew from his extensive experience for an interesting and highly informative lecture on the development of high strength sintered oxides and their successful application as cutting tools. Blackboard illustrations were used and a question and answer period followed. *—C. J. Doubek*

SOUTH BEND—Shown from left during a plant tour of the Dodge Plant are: Reg. McIntyre, Don LeMonte, Irvin Warstler, Wilbur Roberts, M. Bortz, and Dick Wozniak.
—Harold Housewerth

Mechanization Is Topic at Hamilton

Arthur K. Godden, technical representative, Bellows Pneumatic Devices of Canada Ltd., declared in his talk entitled "Pneumatics in Industry" that what is commonly thought to be "automation" is in reality mechanization. He defined mechanization as the transfer of skill and effort from man to machines, and automation as the transfer of thinking or sensing through the use of such mechanism as the electronic brain, magnetic, tape or drum devices. Mr. Godden stated that what is termed "automation" in most Canadian industries is mechanization of repetitive and standardized processes for increased productivity, work simplification and cost reduction. This is realized by automatic equipment he pointed out. Following the talk Mr. Godden gave a demonstration of several pneumatic devices.

At the conclusion of the demonstration, five new members were presented with ASTE pins by Chairman J. A. Sheldon.

George Churchill outlined plans for the Silver Anniversary meeting for Zone 5 on March 25. At this special meeting Hamilton District will be host to Toronto, Buffalo, Grand River Valley and Niagara District chapters. Members and ladies are invited to participate in this program. *—Russ Wilson*

Chapter News and Views

BINGHAMTON—Observing a half scale model of the Midget Multi-Barrel are, from left: Donald Mosher, president of BMT Corp.; Ted Black, associate editor of THE TOOL ENGINEER; and Glyn Williams, editorial chairman. *—Glyn Williams*

LITTLE RHODY—Three new members welcomed to the chapter were from left: Louis Sansone, Francis Murphy, and Roland Labrie. *—Richard Kilbane*

DETROIT—Pictured at a chapter party are from left: Grant Wilcox, past chapter chairman; Monty Cox, past chapter secretary; Past President Leslie Bellamy; and Past Chairmen Andy Carnegie and Wayne Kay. *—Tony Rogers*

Windsor Hears Talk By Louis Polk

Louis Polk, addressing a joint ASTE and Society of Quality Control meeting, urged the engineers present to express themselves clearly and positively in selling the philosophy of abundance as essential to both human and technological progress.

Building public confidence in technical and engineering advancements as the servant and not the master of human progress, he stated, should be a key public interest objective of industry's engineering professions.

Addressing the group as "professionals of productivity," Mr. Polk said that engineers are among the best qualified spokesmen for the idea of plenty and abundance as a way of life, because they know that progress and prosperity depend on increased productivity of more and better things at lower cost.

Record Attendance Denver Plant Tour

Two hundred members and guests of Denver chapter attended the meeting held at the C. A. Norgren Co. Chief Engineer J. A. Wilson gave an interestingly illustrated presentation of Norgren products and their application. A plant tour followed which enabled those present to view Norgren's operations. Two of the company's most recent products, the "Micro-fog Lubrication" and the "Spray-lube System" were demonstrated.

Obituaries

James Allison, Akron, vice president and general manager of Sierra Drawn Steel Corp.

George Stephen Kellogg, Potomac, self-employed designer, photographic and other instruments. Special tribute was paid Mr. Kellogg by Potomac Chapter for the tireless effort he put into photographing the chapter's special program, Industry and Education Night.

Robert Knudson, Rockford, assistant sales manager of Greenlee Bros. & Co.'s special machinery department.

E. Kenneth Wheat, Mohawk Valley, project member of the National Technical Publications Committee and chairman of the group that was writing and revising sections in the *Tool Engineers Handbook* covering automation and material handling. He was supervisor of process research, Remington Arms.

members on the MOVE

Louis Polk, Dayton, was named director and officer of Bendix Aviation.

Three Binghamton men received promotions: **Frederick S. Everle** was appointed project engineer in the tool engineering department of IBM's Endicott plant; **James E. Cahill** has been named industrial and plant engineering manager; and **Joseph B. Riffanacht** was appointed assistant manufacturing engineer at IBM in Rochester, Minn.

Carl Schmitz, Chicago, was promoted to executive vice president of the Crane Packing Co.

H. T. Gates, Twin States, is retiring as vice president and factory manager from the Fellows Gear Shaper Co.

Roy G. Mitchell, Detroit, has been elected to chairman of the board of directors, Eclipse Counterbore Co.

Roy W. Bailey, Detroit, has been elected to president and treasurer of Detroit Power Screwdriver Co.

K. H. Wisby, Tulsa, has been promoted to field sales manager of the Southwestern District for the Coastal Abrasives Div., The Carborundum Co.

George W. Stamm, Pittsburgh, has been promoted to general manager of sales of the Crucible Steel.

John H. Locke, Jr., Philadelphia, has been promoted to Eastern district manager of the John Bath & Co., Inc.

Samuel D. Conant has been elected vice president in charge of sales of The Jacobs Mfg. Co.

A. J. Chandler, Cleveland, has been promoted to sales manager of the Brush Div. of The Osborn Mfg. Co.

SPRINGFIELD, MASS.—Officers and guest speakers at a recent visit to Springfield armory are, seated: Col. D. G. Ludlam; Ken Blaisdell, chairman; Col. J. F. Harlan; Otto von Lossnitzer. Standing: R. Marquiss; A. Johnson; Lt. Col. R. E. Rayle. *—A. M. Johnson*

SOUTH BEND—Shown following a plant tour through the Dodge Plant, are from left: **Carl Phillips,** superintendent of machine shop; E. James Nelson, chairman; Carl K. Shank, general superintendent. *—Harold I. Housewerth*

TWIN CITIES—Past chairmen shown at the recent Past Chairmen Night Program are: Peter Tobias, Cliff Lofdahl, Wm. Boker, Wally Alberg, Bob Johnson, Francis Gruber, Harold Sullivan, and Erik Fasth. A representative of Dow Corning spoke on "Silicones in the Metal Industry" at the meeting. *—C. P. Gaudette*

ERIE—Richard Banaszek, secretary, and David Schuler, chairman, are trying to bring the like poles of two magnets together against their force of repulsion, as Arlo Iraelson, chief engineer of Eriez Manufacturing Co., and Eugene Karnes look on. *—Leo Weiner*

Chapter News and Views

PORTLAND, ORE.—The executive committee of the chapter, shown above, was erroneously identified in the January issue. Pictured from left are the chairmen and their committees: Fred D. Mondin, membership; Walter L. Brenneke, editorial and public relations; William Simpson, program; Kay Silvon, standards; Edward S. Reilly, second vice chairman; Robert C. Erickson, chapter chairman; Prof. Milton C. Sheely, first vice chairman; Daniel Melody, delegate; Richard Lyons, treasurer, and Joseph J. Lomnicki, secretary.

Portland Plans Tour to Oregon State

Portland chapter's members will travel to Oregon State College at Corvallis, Ore., eighty-five miles distant, on March 9, to hear a lecture by Dean George W. Gleeson, of the school of engineering and industrial arts. After arriving by bus, they will first tour the campus engineering facilities and shops, and then proceed to a hotel for a luncheon, with Dean Gleeson speaking.

Following the business meeting, buses will transport the travelers forty miles to Eugene, Ore., to view the final Pacific Coast Conference basketball game between Oregon State and the University of Oregon.

Arrangements at the college have been made by Prof. Milton C. Sheely, first vice president of Oregon chapter, who is on the staff of the college, and by the program chairman, William F. Simpson. *—Walter Brenneke*

Tool Plastics Discussed At Santa Clara Valley

Ed Bergdahl, representing Rezolin, Inc., spoke at the January meeting of Santa Clara Valley chapter on the topic, "Tool Plastics Find a Place in Industry." He discussed the use of plastics in the die field, and other industrial applications. Methods of handling, accuracies possible, and life expectancy of the various compounds were touched upon. A question period followed the talk.

After the technical session, Chairman William T. Wright presented pins to six new members. National Program Committeeman James Coulter described the coming Silver Anniversary Celebration in Houston. *—W. H. Forbes*

WESTERN RESERVE—"The Story of Measurement" was included in the program on modern inspection and gauging practice. Shown from left are: L. A. Tubero; V. M. Donegan; C. G. Shelly of the DoAll Co.; and Ray Beatty, program chairman. *—A. I. Bechtel*

Detroit To Make Plant Tour in April

Ross Kogel, chairman of the carbide section, is planning the outstanding plant tour of the year for Detroit chapter on April 27, 1957. Plans have been formulated to take the chapter through the facilities of The Cincinnati Milling and Grinding Machine Co. Arrangements have been made to leave Detroit on Friday, April 26, arriving in Cincinnati Saturday morning, April 27, to tour the plant and return by train Saturday evening.

On December 6, the carbide section presented a program featuring the "how and why" of ceramic tooling. On the panel were D. J. Davis, vice president of manufacturing, Ford Motor Co., Roy Jablouski of G.E.'s Metallurgical Products Div., and Edward Kibbitt of The Carborundum Co.

Under discussion were the manufacture and application of ceramic tools.

—Tony Rogers

Magnesium Tooling Topic At Northern New Jersey

Ned Swayze, assistant mill products manager for the Magnesium Div. of Dow Chemical Co. presented an address on "The Advantage of Magnesium in Tooling Applications." Mr. Swayze discussed the properties, values and costs of modern magnesium in relation to light metals. A movie, "Treasure from the Sea" preceded the discussion. Color slides of magnesium tooling applications and a demonstration of the machineability of magnesium were presented.

—John Cooke

COLUMBUS—On the slate to be presented for election are, from left: Carl P. Hooge, Motch & Merryweather, chairman; James F. Leonard, treasurer, and Robert E. Snider, second vice chairman, both from North American Aviation; Carl J. Winkleman, Denison Engineering Co., secretary; Archer B. Jones, Jeffrey Mfg. Co., first vice chairman; and William W. Hudson, The Fred D. Pfening Co., delegate. *—William Hudson*

chips and CHATTER

"Precision Barrel Finishing" was the subject on which Frank Soper and Donald Mosher of the BMT Mfg. Corp. addressed **Binghamton** chapter's meeting. An interesting display of machines and compounds was on exhibit.

Ted Black of THE TOOL ENGINEER gave a talk on the magazine.

California State Polytechnic heard Edward Kibbit, manager of the sales department, Stupalox, speak on "Application of Oxide Cutting Tools"

"Sounds around Us" was the title of **Calumet Area's** fourth annual ladies night program. J. E. Udell of the Bell Telephone Co. used a tape recorder to demonstrate magnification of sound. He described sound wave form and frequency by means of an oscilloscope, and explained the functions of a telephone speaker by means of a sectional model. Mr. Udell concluded his talk by displaying a comparison chart of the structure of the ear and telephone.

William Kennecott, chief engineer, Kennametal Inc., spoke to **Fond du Lac** on the latest developments in carbide compositions and carbide tool design. Mr. Kennecott also discussed bridging the gap between metal research and application in metal-cutting shops.

Golden Gate met on January 16 to hear Elmer Hallberg speak on "Duplicators as Applied to Planers, Shapers and Lathes." Mr. Hallberg has just returned from a four-months' tour of Europe where he visited the Swedish Machine Tool Builders' Show.

In order to acquaint the members of **Long Island** with the possibilities of drop forging, Robert Merrill, president, Merrill Bros., was invited to the January meeting. A sound color film preceded his talk.

LEHIGH VALLEY—Special guest Walter Zegveld of the Netherlands Embassy, second from left, inspects ceramic bit held by Speaker James Edge of Sintox. Chapter Chairman V. Scalese, left, and C. Kay, program chairman, look on.

PATERSON—William D. Hart, left, from Fairchild Publications, New York, was guest speaker at a recent meeting, at which he spoke on "Progress of Tool Engineering Throughout Passaic and Bergen Counties." Shown with him, from left, are Chairman George Fleming, Treasurer William Aucamp, and Program Chairman F. J. England. Chairman Fleming presented a report from the public relations chairman on plans for the Silver Anniversary program and closed circuit broadcast. *—C. M. Bazas*

HAMILTON DISTRICT—Preceding a talk on "Pneumatics in Industry," members are shown examining exhibits. From left they are: William Dawson; C. Bulmer; Speaker Arthur K. Godden, Bellows Pneumatic Devices of Canada Ltd.; Clayton Henderson, Grand River Valley chairman; and Joseph A. Sheldon, chapter chairman.
—Russ Wilson

CALUMET AREA—Shown at the fourth annual ladies night are, from left: Chairman and Mrs. David MacGregor; J. E. Udell, assistant staff supervisor, Bell Telephone Co.; Mrs. David Lambie and Vice Chairman Lambie. *—Michael T. Kulan*

Coming Meetings

National

ASTE 25th Annual Meeting and Silver Anniversary will be held Saturday, March 23 through Thursday, March 28 at the Shamrock-Hilton Hotel, Houston, Texas.

CARBIDE SUBCOMMITTEE OF NATIONAL STANDARDS COMMITTEE — March 11 at 9.30 a.m. and March 12 at 9 a.m. at Headquarters, Detroit.

Regional

Rocky Mountain Chapters—May 18, Flagstaff, Ariz.

Chapter

ANN ARBOR AREA—Mar. 25, 7 p.m., American Legion Post, Saline, Mich. Walter McCarthy, Detroit Edison Co., on "Uses of Atomic Energy." Installation of officers with special closed-circuit audio broadcast of ASTE Silver Anniversary program from Houston.

BALTIMORE—Mar. 1, 7:30 p.m., dinner and dance, American Legion Hall, Towson, Md. Installation of officers.

BOSTON—Mar. 14, 6:30 p.m., Normandy Room, Norumbega Park, Newton, Mass. Ladies night and installation of officers.

BUFFALO-NIAGARA FRONTIER—Mar. 9, 7:30 p.m., Buffalo Launch Club, Grand Island. Installation, party and dance.

CLEVELAND—Mar. 25, 8 p.m., Hotel Statler. Special program, Silver Anniversary.

DETROIT—Regular Section, Mar. 21, ladies night, installation of officers. Carbide Section, Mar. 14, plant tour of Cincinnati Milling Co.

ELMIRA—Mar. 25, 7 p.m., Mark Twain Hotel. William E. Emerson, manager, Mark Twain Hotel, on "Hotel Managing Problems." Silver Anniversary national hookup.

ERIE—Mar. 25, 6:30 p.m., Boston Store. Silver Anniversary installation, style show and ladies night.

FORT WAYNE—Mar. 25, 6:45 p.m., The Hobby Ranch House. Coffee speaker, John Thimlar. Ladies night and Silver Anniversary national hookup.

GRAND RIVER VALLEY—Mar. 1, 8 p.m., Shep's Hall, Galt. "Industrial Diamonds" by J. K. Smit & Son.

GREATER NEW YORK—Mar. 4, 6:30 p.m., New York Times Service Dining Room. Installation and two speakers. M. R. Abacemaro, Markite Corp., "Anal. of Speeds, Feeds and Materials." L. H. Wadsworth, Special Control Inst. Co., "Ball Bearing Torque Tester."

HAMILTON DISTRICT — Mar. 8, 6:30 p.m., Brant Hotel, Brantford. Geoffrey Eyton, production control manager, General Motors Diesel Ltd. on "Evolution of Material Handling."

HARTFORD—Mar. 4, "Automatic Gaging," Pratt & Whitney Co., Inc.

HENDRICK HUDSON—Mar. 20, Panetta's Restaurant. Joint meeting with Schenectady chapter to celebrate Silver Anniversary. Report from committee forming a student chapter at the Hudson Valley Technical Institute in Troy.

INDIANAPOLIS—Mar. 7, 7 p.m., Antlers Hotel. Stanley R. Cope, president, Acme School of Die Design, on "Tool Engineering in General." Mar. 25, a special meeting for members only, Boulevard Room, Antlers Hotel. Special program from Houston.

LANSING—Mar. 25, 7 p.m., Lansing Civic Center. Dinner and closed circuit broadcast from Houston.

LEHIGH VALLEY—Mar. 15, 6:30, Hotel Traylor, Allentown. Installation of officers and short talk on "Skin Diving."

LITTLE RHODY—Mar. 25, 7 p.m., Pilot Room, Johnson's Hummocks. Film of Chicago Meeting of 1956 to be shown, and participation in program from Houston.

LONG BEACH—Mar. 13, 7:30 p.m., The Petroleum Club. "Let's Get the Low-Down," representative of Eureka Tool & Die Co. Installation of officers and past chairmen's night.

LONG ISLAND—Mar. 25, 7:30 p.m., Garden City Hotel. Fashion show, business meeting, Houston broadcast and entertainment.

LOUISVILLE—Mar. 12, 6:30 p.m., L & N YMCA Hall. "Gun Drilling," Madison Mfg. Co.

MADISON—Mar. 25, 6:30 p.m., The Cuba Club. Dancing, ladies night and ASTE program from Houston.

MERRIMACK VALLEY—Mar. 7, 6:30 p.m., Rex Grille, Lowell. Executive night and installation of officers.

MID-HUDSON—Mar. 9, 6 p.m., Beekman Arms, Rheinbeck, N. Y. Ladies night and installation of officers.

MILWAUKEE—Mar. 25, 6:30 p.m., Serb Memorial Hall. Installation of officers and program of Silver Anniversary celebration from Houston.

MONADNOCK — Mar. 21, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria. Melvin Knapp, metallurgist, Brown & Sharpe Mfg. Co., on "Metallurgical Problems in Tool Design."

MUSKEGON—Mar. 25, 6:30 p.m., Doo Drop Inn. Ladies night, dinner meeting, installation of officers and Houston Silver Anniversary hookup.

NASHVILLE—Mar. 25, 5:30 p.m., Jones & Laughlin Steel Co. Lou Webb, general manager of Jones & Laughlin. Warehouse tour.

NEW HAVEN—Mar. 25, 6:30 p.m., Hotel Garde. Silver Anniversary celebration from Houston.

NORTHERN MASSACHUSETTS—Mar. 19, 7 p.m., U.T.D. Recreation Hall, Athol. Talk on "The Story of Measurement."

NORTHERN NEW JERSEY—Mar. 12, 8 p.m., Essex House Hotel, Newark. Annual executive night dinner. D. J. Davis, vice president in charge of manufacturing, Ford Motor Co., on "New Horizons in Manufacturing."

OAKLAND COUNTY—Mar. 25, 8 p.m., Kingsley Inn. Social evening and national hookup.

OKLAHOMA CITY—Mar. 25, 6:30 p.m., 3400 N. W. 39. Ladies night dinner and dance.

OZARK—Mar. 25, 7:30 p.m., Connor Hotel, Joplin. Installation and social meeting.

PEORIA—Mar. 5, 6:30 p.m., Pere Marquette Hotel. "Tooling for Automation" by Harry Conn, vice president, Scully-Jones & Co.

PHILADELPHIA—Mar. 21, 7:45 p.m., Engineers' Club of Philadelphia. Panel discussion on "Shaping & Planing with Carbides."

PITTSBURGH—Mar. 1, Gateway Plaza. Past Chairmen's Night and talk by James Weaver, manager Westinghouse East Springfield Works.

PORTLAND, ORE. — Mar. 9, Corvallis, Ore., all day; Eugene, Ore., in the evening. Caravan buses and cars. Dean Gleason, School of Engineering, O.S.C. Mar. 25, 6 p.m., Burns Restaurant, N.E. Sandy Blvd. Installation of officers and Silver Anniversary party.

ROCHESTER—Mar. 4, John J. Scherer, Kalamazoo Div., New York Air Brake, on "Hydraulic Controls on Machine Tools." Installation of officers.

ROCKFORD—Mar. 25, 7:45 p.m., Lafayette Hotel. Installation of officers and Houston Silver Anniversary celebration.

SAGINAW VALLEY—Mar. 21, installation of officers. Scholastic awards. "The Handbooks and Their Value to Us," Frank Wilson, ASTE technical director.

ST. LOUIS—Mar. 7, 6:30 p.m., Kingsway Hotel. Executive night and installation of officers. Mar. 25, special meeting, Kingston Hotel. Silver Anniversary celebration.

SANTA CLARA VALLEY—Mar. 9, 6 p.m., La Rinconada Golf Club, Los Gatos. Annual ladies night, dinner dance. Chairman's annual report and chairman's pin award. Installation of officers.

SCHUYLKILL VALLEY—Mar. 12, 6:30 p.m., John C. Wilson, Thompson Grinder Co., on "Crush-Form Grinding." Celebration of first anniversary with installation of officers.

TWIN STATES—Mar. 13, 7 p.m., Adna Brown Hotel. George Morin of Jones & Lamson Machine Co. on "Tooling and Machine Tools for Short-Run Work." Installation of officers.

TORONTO—Mar. 6, 7:30 p.m., Oak Room, Union Station. Election.

TRENTON DELAWARE VALLEY—Mar. 25, 8 p.m., Hotel Hildebrecht. 6:30 dinner. Technical film and Silver Anniversary celebration.

TRI-CITIES—Mar. 13. Past Chairmen's night.

TWIN CITIES—Mar. 6, 5:30 p.m., Covered Wagon, Minneapolis. D. A. Dobbins, field engineer, Diamonite Mfg. Co. on "Ceramics."

UNIVERSITY OF KANSAS STUDENT CHAPTER—Mar. 14, 7 p.m., Fowler Shops of University of Kansas.

UTAH STATE STUDENT CHAPTER—Mar. 7, 4 p.m., Room 203, Mechanics Arts Bldg. Regular business meeting and discussion of Agathon and party.

WILLIAMSPORT—Mar. 7, 6:30 p.m., for dinner. Program at 7:30 p.m. features "The Earth's Satellite Vehicle" by Mr. Williams, the Martin Co. Colored slides, and a film on U. S. Navy's Viking Rocket.

WINDSOR—Mar. 25, 7:30 p.m., Caboto Hall, sponsored by Border Tool & Die. Installation of officers and Silver Anniversary hookup.

WORCESTER—Mar. 5, 6:30 p.m., Putnam-Thurston's Restaurant. "Abrasive Tumbling," Malcolm M. Maynes, Norton Co.

Position Wanted

AGGRESSIVE INDUSTRIAL SALES ENGINEER—age 33, married, college graduate, 7 years' industrial sales, cutting tools and abrasives, close association with industrial distributors, with following in Eastern, Central and Northwestern Ohio, desires affiliation with reputable manufacturer or manufacturer's agent with highest quality lines. ASTE member, Columbus, Ohio. Write to: Box 095, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Position Available

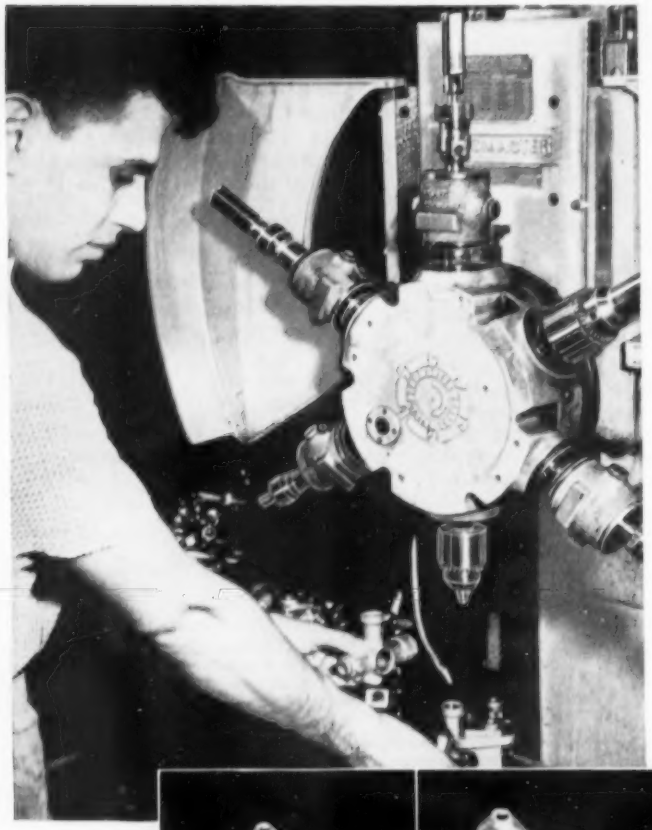
CARBIDE SALESMAN—Excellent opportunities available in Chicago, Cleveland, Buffalo, Milwaukee, Philadelphia, Indianapolis and Boston areas with manufacturer of top quality carbides. Salary, incentive, expenses. Write to: Box 093, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Technical Papers Made Available

In order to fill the many requests made by our readers for separately-bound copies of numbered technical papers presented at the Convention, a mail order form appears on page 454.

BURGMASTER® 6-Spindle Turret Drill

increases production **200%** at J. & S. Carburetor Co., Dallas



Here is a "before and after" story which indicates Burgmaster's great ability to increase production, save time, reduce operator fatigue, and improve accuracy and quality of work.

This experience is one of many. If you have a job requiring multiple operations (drilling, reaming, tapping, counter-boring, etc.), this can be accomplished in one setup, with one operator, automatically with a Burgmaster.

This part, shown in production plant photo, is die cast zinc 600 regulator body. Four tapping, one core drilling operations are performed in one setup, using indexing fixture. Production, 32 parts per hour. Rejections, less than ½ of 1%. No comparative data available as machine was purchased for this operation.

Vaporizer head (B1112 mild steel) work performed on the circumference and consists of center drill, 2-step drill, drill and chamfer, drill and tap. Work done in one setup on indexing fixture. Production, 17 per hour. Tolerances, .001″ in size, .005″ in depth. Production increased 200%. Rejections decrease from 4% to less than ½ of 1%. Six drill press, two turret lathe operations were eliminated.

For complete information, write Dept. TE-3

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

RIDGEWOOD, N. J. • CLEVELAND • DETROIT • CHICAGO • SAN LEANDRO, CALIF.
(In HOUSTON, see WESSENDORFF-NELMS CO.)

PROGRESS IN PRODUCTION

FAST, SEMIAUTOMATIC WELDING PROCESS INTRODUCES SPECIAL TECHNIQUES AND EQUIPMENT

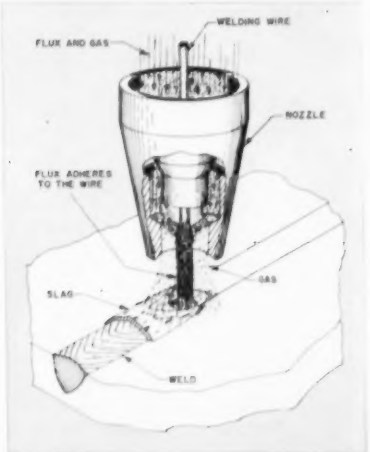
Welding from any position at fast speeds with high-quality results is accomplished with a new arc welding process utilizing a continuously fed wire electrode which is magnetically coated with flux and shielded in a gas atmosphere. This new semiautomatic metal arc welding process, called Unionarc, was developed by Linde Air Products Co. It uses a continuously fed bare wire, powdered magnetic flux and carbon dioxide gas. The bare wire electrode, made of copper coated mild carbon steel rod, is fed from a 300-lb capacity pack through a flexible tube to the torch. Once started, the welding is continued to suit the operator's requirements. It is not necessary to stop to change electrodes, or to make a joint. A special Pay-Off Pak, which keeps the wire covered and clean, is supported and rotated on a motor-driven turntable, controlled so that wire tension at the feed roll is minimized.

Magnetizable flux is fed from a dispenser through a flexible tube to the torch in precisely measured amounts in proportion to the amount of wire that is being fed. While the usual flux-to-wire ratio is between $\frac{3}{8}$ to $\frac{1}{2}$ lb of flux per pound of wire, the dispenser can be adjusted to feed different ratios. This predetermined ratio is automatically maintained regardless of the rate of wire feed.

The flux is fluidized at the dispenser in a stream of welding grade carbon dioxide gas which is regulated as to pressure and flow and carries the flux to the torch suspended in the gas stream.

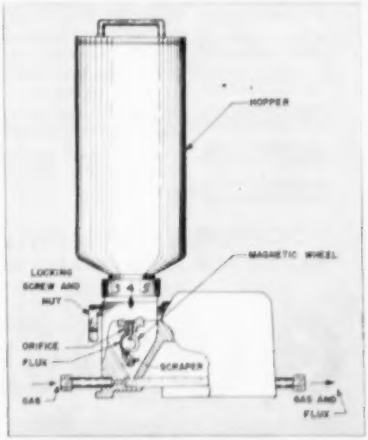
At the torch nozzle, the magnetic field created by electric current passing through the wire magnetizes and attracts the flux to the wire as a coating as it is fed into the arc. Melted flux, together with the shielding gas, stabilizes the arc and the stream of molten metal passing through it to the puddle and protects the puddle from atmospheric contamination. Melting flux also

Drawing of torch nozzle shows details of its design and function.



As operator pushes the 2-way control switch on the Unionarc torch handle, welding wire and flux issue simultaneously from the torch nozzle.

Drawing shows main points of hopper which feeds the equipment. This powder dispenser holds 25 lb of powder; normally an 8-hour supply. The easily read dial indicates the flux-to-wire ratio. Flux feed rate is adjusted by the operator by rotating the hopper.



refines the molten metal by deoxidation; provides desired control of weld contour by its effect on surface tension, and provides desired cooling rate of the weld metal by its blanketing and insulating action.

Arc characteristics are similar to those of covered electrode welding. Resultant weld has a penetration of from 3/16 to 1/4 in. as opposed to the normal 1/16 in. penetration achieved by conventional processes. Ordinarily metal transfer is spray type and spatter is minimized, and that small amount of spatter can be readily removed by wiping or light brushing. On cooling, slag begins to rise of its own accord leaving a clean, smooth weld seam.

Welds produced by Unionarc easily meet radiographic requirements set forth in ASME boiler and pressure vessel code. Fillet, butt and plug welds, as well as steel casting repairs show consistently high radiographic quality. For test purposes all plate used had normal mill scale or rust, and joint edges were prepared by oxygen cutting. There was no preweld preparation of the joint, such as grinding or wire brushing.

Slag rises from the weld as it cools. This characteristic avoids need for preweld cleaning of the plate and reduces postweld cleaning time.

Examination of quality of multilayer welds showed typical mechanical properties to include a yield strength of 66,000 psi, ultimate tensile strength of 78,000 psi, elongation of 28 percent in 2 in., and a weld hardness of 78 to 85 R_B+.

An electronic control unit serves to regulate sequence of starting and stopping the flow of current, wire, flux and gas, as well as maintaining proper welding conditions.

Rate of welding deposits by the Unionarc method is 50 to 100 percent greater than that conventionally obtained on most common downhand welding applications. In vertical and overhead positions, deposition rate is two to three times as great as that of covered electrode welding.

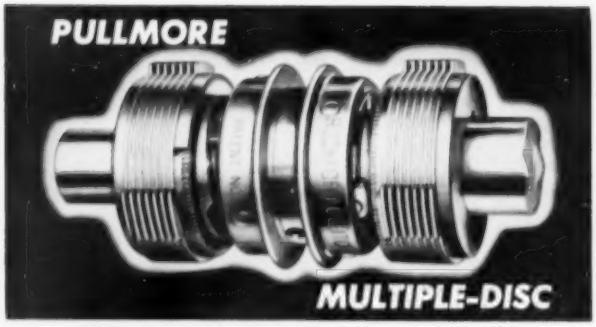
In practical applications, the process can be used to weld across gaps and along seams containing moderate amounts of rust, scale and moisture without any effect on weld soundness.

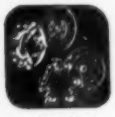
Welding techniques used with Unionarc are comparable to those employed with conventional electrodes.

SPEEDY TEMPLATE TURNOUT BY TAPE FED UNITS

Tape programming has been successfully adapted to template production. The system for batch production consists of coordinates of the points of change around the periphery of the workpiece, and the type or shape of curve to be generated between, is transformed through a teletypewriter into a series of punched holes on paper tele-

ROCKFORD




Small Spring Loaded

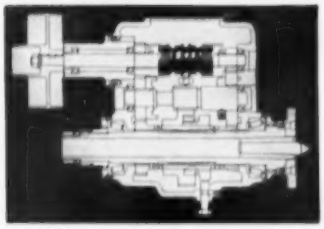
Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers



CLUTCHES (Single or Double) PROVIDE HIGH TORQUE -- LOW ENGAGING PRESSURE

COMPACT DESIGN
HIGH TORQUE
HIGH-RATIO LEVERS
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

* PULLMORE discs provide high capacity and efficient lever design enables light engaging pressure. Discs are accurately made from special clutch-disc materials and are tested for flatness. Made in single and double types, for operation in oil or dry, PULLMORE clutches have capacities from 1 to 90 H.P. at 500 R.P.M. They handle loads of much greater than rated capacity, when operated at higher speeds.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD Clutch Division BORG-WARNER
1329 Eighteenth Ave., Rockford, Ill., U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-190

printer tape and are used as the primary information input to a digital computer.

Path the cutter must traverse to produce a workpiece of given shape and size is calculated by a computer. The computed information is then recorded on a magnetic tape as a series of control puses, and the tape played back on a control unit which is connected to the machine tool. Control pulses thus transmitted operate the separate tool slides in the appropriate manner and cause the cutting head to machine the template to the required shape.

The prototype template making machine, designed and produced by Ferranti Ltd. of Edinburgh, Scotland, was shown at the Exhibition of the Society of British Aircraft Constructors. Ferranti also designed the system as a whole. Equipment consists of a fixed worktable spanned by a bridge unit carrying the cutting head. The bridge unit is free to travel along the length of the worktable while the cutting head can be traversed across the width of the worktable.

SPECIAL DRILLING SETUP NETS TIME ECONOMY

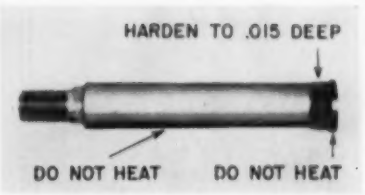
Thirty-four holes are drilled simultaneously in two passes to provide 68 holes drilled at a 45 deg angle in a circular pattern in a cast iron gas burner. Hole diameter is $\frac{1}{8}$ in.

Air actuated clamping fixture on an index table is loaded by the operator. The drill head is fed automatically, drills being gear driven into and out of the burner by cam feed electrical control. When drills retract, the operator indexes the part to drill remaining half of the circle. After the second pass the fixture is unloaded. Up to 135 burners per hour have been drilled in this manner using a Zagar radial drilling unit.

POWDER CORE TRANSFORMER ALLOWS FAST HARDENING

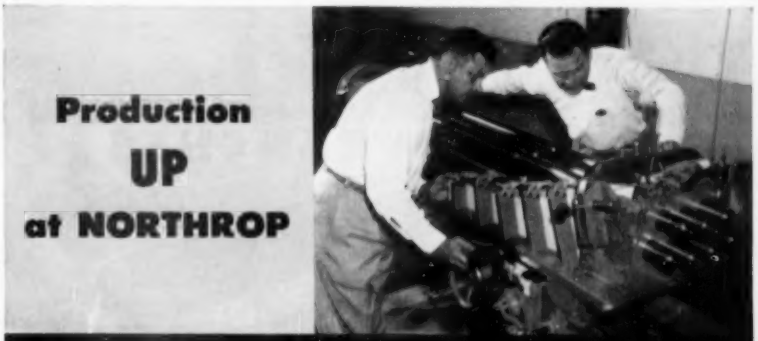
Induction heaters incorporating powder core output transformers have provided means for a new method of fast induction hardening. A special problem in hardening points up an advantage of the process.

In the spring shackle bolt shown in the photograph, the knurl was to be hardened to a depth of approximately 0.012 in. while the shank adjacent to the knurl and the shank under the knurl were not to be heated. The pin itself is driven into a hardened spring, and the knurl must be hard to penetrate and hold. The head must remain soft to take the blow of pounding without shattering. Ordinarily, minimum time



lengths required for induction heating would allow the shank to be heated unless it were sprayed with a stream of water.

By using a type of ultra fast induction heater made by Radio Frequency Co., the operation was accomplished in $\frac{1}{10}$ sec on a 10 kw machine. Because of the speed of the operation, no quenching is necessary. Residual cold of the



KNU-VISE clamps help cut drilling time

Model HS-400

Wherever fast, positive material holding is required—Knu-Vise toggle-action clamps are helping manufacturers do a better job.

One application is shown above. This time Knu-Vise clamps are in use on a special fixture developed by Northrop Aircraft engineers for simultaneous drilling of seven rocket pod orifice holes for the Northrop F-89 Scorpion. Drilling time has been reduced from 10 hours to 45 minutes—including set-up time.

REMEMBER—if you have a holding problem—Lapeer Mfg. Co. offers a wide range of hand, air and oil operated clamps to increase efficiency and lower costs. Our catalog contains complete information. Write for your copy today.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

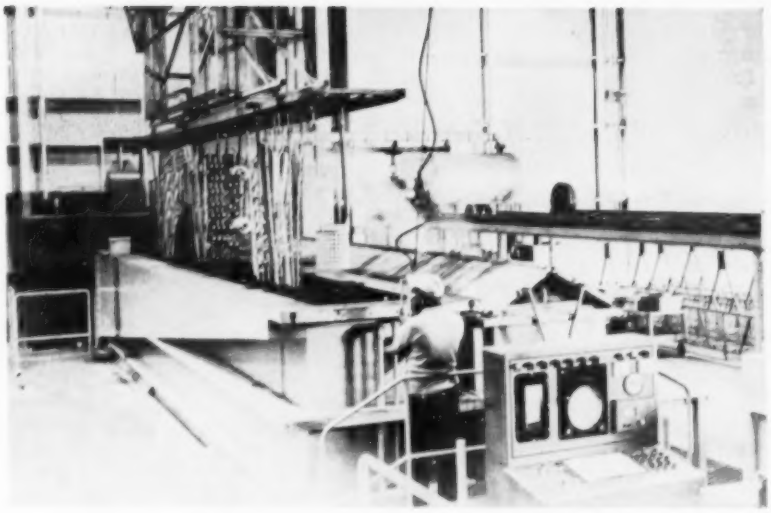
3053 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-191

pin prevents its heating and only the knurl is heated and hardened.

Theoretical output is approximately 10 units per hour. In practice, 3500 units per hour are easily processed. The operator only pushes the pin into the coil where it automatically turns on the machine for ¼ sec., and removes it.



AUTOMATIC ANODIZING NETS ECONOMY

Aluminum parts are automatically anodized at Douglas Aircraft Co. with equipment powered by a germanium rectifier. The General Electric 3000 amp-50 v rectifier, shown at the far end of the tank, is equipped with a special control that starts the anodizing cycle under constant current conditions and limits current flow until the anodic film builds up. At desired voltage, the unit switches to automatic voltage control until the process has been completed. Entire cycle is adjustable and automatic. The setup has resulted in savings in time, manpower, space, materials and electric power.

ARMSTRONG
WRENCHES
ARMSTRONG U.S.A.
ARMSTRONG U.S.A.
Choose Your Wrenches as you do your friends--for life
Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.
Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality
WRITE FOR CATALOG
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5217 W. ARMSTRONG AVENUE CHICAGO 30, ILL.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-192

FORSEES CLIMB IN TITANIUM APPLICATIONS

Titanium, developed primarily for defense needs, will have numerous additional uses in civilian industry within five years according to Dr. Ronald L. Carmichael, economist at Battelle Institute, writing in *Battelle Technical Review*. Although at present the cost is relatively high, this can be expected to drop as producers and consumers gain experience with the metal. Within the next five years, he predicts titanium sheet, rods and bars should sell at one-third to one-half of current prices. By then, because of its superior properties, titanium will be economically practical for many uses in chemical and process industries in certain consumer products.

Most applications of the metal are made to take advantage of its corrosion resistance quality, its high strength-to-weight ratio, or its abrasion resistance. In addition, because it is resistive to many corrosive solvents, titanium does not contaminate materials coming into contact with it. It is estimated that from 50 to 100 different applications of titanium already have been made in prototype products for nonmilitary uses.

Among titanium's shortcomings, besides its present high cost, are its poor resistance to certain powerful reducing agents, lack of availability in certain forms, difficulty in welding certain alloys, problems of galling (which is preventable), and high scrap loss due to

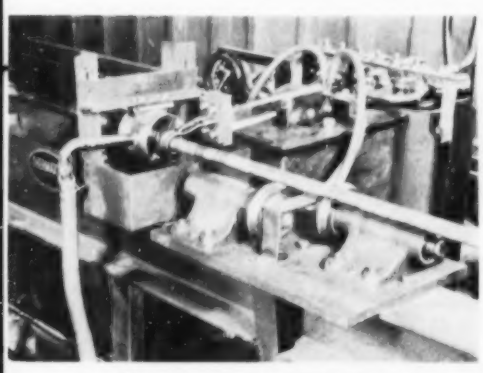
mexperience of the fabricators. Dr. Carmichael feels that most of these shortcomings should be overcome as research continues and as users of titanium gain experience with it.

Government policy now permits titanium producers to channel up to 10 percent of their mill products into nondefense end uses. This situation provides incentive to find civilian application for the metal, which, in turn, leads to increased research.

PROGRESSIVE HARDENING WITH HIGH FREQUENCY HEAT

Uniform hardening of mill length shafting to specified hardness and depth is achieved by efficient application of high frequency induction heating. The Thermatool progressive rod hardening mill, designed and built by New Rochelle Tool Corp., hardens carbon steel rods up to 4 in. in diameter and 30 ft and longer in length, without distortion. Work is carried on continuously with push button simplicity.

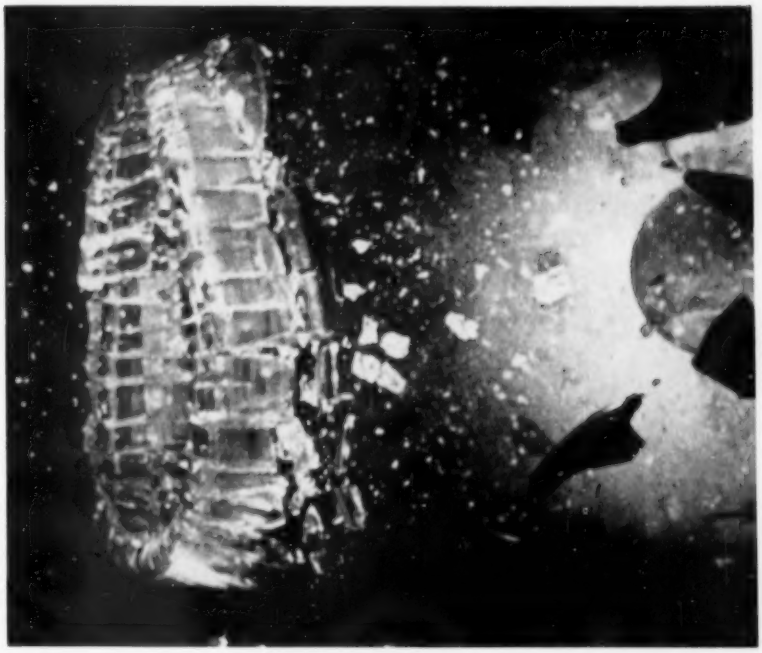
The mill has a skewed roll arrangement driven by two 1 hp variable speed motors. Design permits the feed rate



Closeup view of induction heating section of the progressive rod hardening mill. Drum shaped unit surrounding the coil is a water quenching spray fed by the pipe at the left.

and rotation speed of the rods to be adjusted independently. Feed rate, rotation speed and amount of power determine depth and degree of hardness obtained in the steel rods.

The induction coil, through which the steel rod passes in the continuous hardening process, is energized by a 50 kw, 9600 cycle motor generator. Production rates vary according to rod diameter, hardness, depth of hardness and amount of power used. For example, hardening rods to 60 Rc to a depth of 0.060 to 0.250 in., production speeds are approximately ½ in. at a rate of 50 ipm, 1¾ in. at 10 ipm, 3 in. at 4 ipm, or 4 in. at 3 ipm.



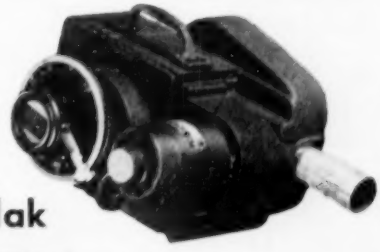
Single frame from a high speed movie of an imploding television picture tube—a critical instant seen in relation to what preceded and followed during a spread-out fraction of a second.

Ever see a really high speed movie?

It's something to see—a one-second swipe of a cutting tool spread out to three minutes on the screen! Seeing a cam that is really turning at 500 RPM (and behaving that way) as though it were turning at 3 RPM! Studying the action of explosions, welding bead deposition, forging . . . all slowed as much as 200 times from normal.

We've put together a movie on the Kodak High Speed Camera that will show you what high speed movies can do. It will also give you some ideas on how you might put high speed movies to work solving your own design, production, and performance problems that involve high speed mechanical action or fluid flow. To arrange for a showing to company groups of the 16mm sound movie, "Magnifying Time," write:

EASTMAN KODAK COMPANY, Rochester 4, N.Y.



the Kodak HIGH SPEED Camera

Kodak

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-193

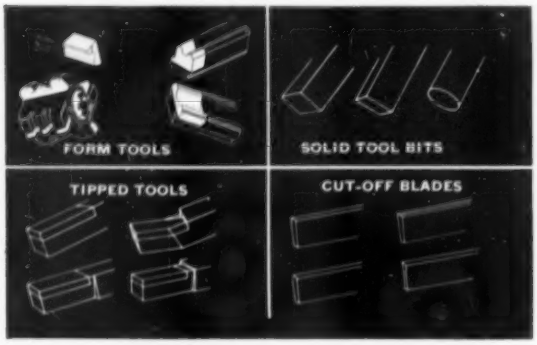
GREENLEE

WARNER & SWASEY

BROWN & SHARPE

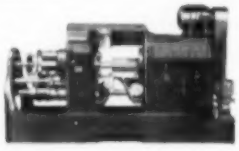
BARDONS & OLIVER

How to Reduce Costs by Tooling Automatics with V-R TANTUNG Cast Alloy



NEW BRITAIN

CLEVELAND



ACME-GRIDLEY

CONOMATIC

TANTUNG is a natural for single point and form tools for automatics, *particularly on short runs.* It is an exclusive chill cast alloy containing carbides of tungsten, tantalum and columbium—has high red hardness . . . low coefficient of friction . . . and high transverse rupture strength. It offers these cost-saving advantages:

1. ***Lower Grinding Cost.*** Tantung is easy to grind straight or to form. You do not need diamond wheels. Aluminum oxide wheels, such as used for hardened steel, are suitable. This feature effects major savings over carbide tools for short runs.

2. ***Lower Tool Cost.*** Tantung is available in solid tool bits, permitting many more regrinds than are possible with a brazed tip tool.

3. ***Higher Production.*** Tantung permits cutting speeds at least 50% higher—and up to 100% higher—than those possible with high speed steel.

4. ***More Efficient at Moderate Speeds.*** Tantung tools operate successfully at speeds too slow for efficient use of carbide and too high for HSS. They are ideal on multiple tooling setups where surface speeds of one or more operations fall below the carbide cutting range.

5. ***Available Cast-to-Form.*** By specifying preformed Tantung, you reduce grinding costs and secure longer tool life.

Whenever you are tooling automatics,
it pays to keep Tantung in mind.

SEND FOR FREE BOOKLET:

"Where and How to Use Tantung", a new booklet just off the press, gives complete information about Tantung—describes its characteristics . . . tells how to grind and braze it . . . explains the cost-saving advantages of specifying it cast-to-form . . . shows cutting speed ranges . . . describes multiple tooling setups . . . shows how it gets more work out of older machine tools that can't handle carbides. Send for your free copy, without obligation.

Tantung and V-R are registered trademarks of Vascoloy-Ramet Corporation

T-608

Vascoloy-Ramet Corporation

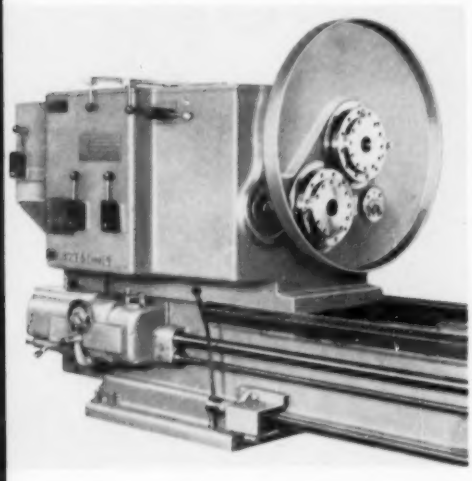
870 Market Street, Waukegan, Illinois

TOOLS *of today*

Dual-Spindle Lathe

Designed to allow turning of both large and small-diameter work, this dual-spindle lathe serves as two machines in one. Upper spindle of the lathe provides an over-the-bed swing of 60 in. and the lower spindle provides a swing of 40 in. The two spindles are positioned for convenience of operation; point of contact between work and tool is always within sight and convenient reach of the operator.

Various drives may be engaged or disengaged quickly under protection of



a mechanical safety-interlock arrangement which prevents machine-damaging movements. Work can be held stationary between the upper spindles while an attachment, mounted on the carriage, performs milling or grinding operations throughout the entire length of carriage travel.

The lathe is built to support 15 tons between centers. Beds may be had in any required length, and in one piece up to 35 ft between centers. All standard attachments are available and applicable.

The Boye & Emmes Machine Tool Co., 81 Caldwell Dr., Cincinnati 16, Ohio. **T-3-1951**

Wet Abrasive Cutting Unit

Model 481 wet abrasive oscillating cutting machine cuts large-diameter bar stock, tubing and other shapes in ferrous and nonferrous metals.

Equipped with a 26-in. diam abrasive cutting wheel, it will cut practically any metal within its capacity of 8 in. square solids with a minimum of burr. Wheel feed and work clamps are hydraulically operated; the work bar is hand fed.

Main bed of the unit is made of heavily ribbed and welded steel and is constructed with a self-draining coolant collector. Spindle is mounted in separate housing, which is adjustable for accurate alignment.

Motor mounting and connection is such that there is no belt tension load on the motor bearings. Any desired degree of tension can be applied to the belts and maintained regardless of amount of load imposed by the cutting wheel.

The oscillating unit is power driven by a 1-hp geared head motor, at a constant speed. The wheel arm is mounted on an oscillator link mechanism, causing the abrasive wheel to move back and forth across the workpiece at the same time that it is fed hydraulically through the workpiece. The wheel guard is permanently fixed to the bed of the machine and entirely

encloses the wheel except for openings on either end for entry of work.

The Model 481 is furnished with a 25-hp, 1800-rpm, totally enclosed, fan-cooled motor to drive the abrasive wheel. Drive from the motor to the spindle is through multiple V-belts.

Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn. **T-3-1952**

Automatic Bar Feeder

Three sections of this automatic bar feeder include a hopper, a transfer table and a V-roll conveyor. The hopper (at right in the illustration) is designed to receive 10,000-lb bundles of 2 in. diam x 20 ft long round steel bars or tubes from an overhead crane. The table (center), consisting of cross chain conveyors mounted on steel supports, transfers and meters the bars or tubes from hopper to the V-roll (left) which feeds the bars or tubes to the cutoff machine or a furnace.

Feed to the cutoff machine is at a specified rate of speed. When the rear

DUPLICATE HOLES
Automatically!
WITH THE WALES
FABRICATOR-DUPLICATOR

PUNCH ACCURATE HOLES FROM ANY MASTER TEMPLATE!

Holes in the template, mounted on the Duplicator, are automatically precision punched in the work piece . . . which is mounted on the Fabricator. Any size or shape hole within the limits of 3½" dia. can be handled on a quick change basis. Punch and die changes are made in seconds so that patterns with various size holes can be duplicated at high speed. This equipment is a complete punching shop in itself . . . fast . . . accurate . . . rugged and priced within the reach of any shop.

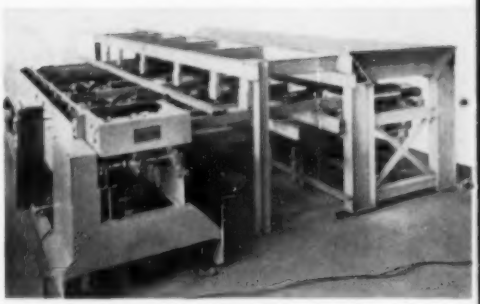
See us at IRE show, New York
Booth 4010—March 18-21

WALES MOBILE FIELD UNITS
We'll bring the Fabricator-Duplicator right to your door for a demonstration. Ask for details.

SEND FOR BULLETIN NO. 26B
Time studies, specifications illustrations etc., are all yours for the asking.

WALES *Strippit* COMPANY
"...the Wales-Way is the PLUS-PROFIT way"
AKRON, NEW YORK
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-196



end of the bar approaches the cutoff unit, a flag signals the conveyor's escapement fingers and the next bar is delivered immediately back of the preceding bar. As a result, operation at full capacity is continuous.

Spurgeon Co., 23501 Hoover Rd., Van Dyke, Mich. **T-3-1961**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Routers

Precision ground to close tolerances, these solid carbide routers are suitable for use on abrasive materials such as plastics, bakelite, die castings, copper, fiber, bronze, brass, aluminum, hard wood, hard rubber, etc.

A full range of standard sizes are available in all designs, such as single

straight flute, right-hand spiral, single left-hand spiral, two-flute straight, two-flute left-hand spiral and three-flute left-hand spiral. Special requirements can be fulfilled upon application.

The Atrax Co., Newington, Conn. **T-3-1962**

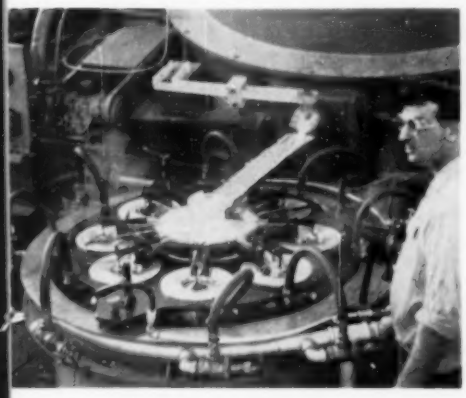
Automatic Casting Machine

Both heavy and light nonferrous metals can be handled in this continuous casting machine. Compact and simple to operate, it is suitable for casting a wide variety of shapes varying from either solid or hollow round extrusion billets to rectangular rolling mill cakes and slabs. The machines are capable of producing billet sizes from 3 to 20 in. diameter and larger. A spe-

cial automatic flow control system allows a single machine operator to be responsible for the casting of as many as 20 multiple strands simultaneously. Less than 1 percent of the metal is lost in the form of gate on top of the ingot.

The equipment can be arranged for either continuous or semicontinuous operation. Semicontinuous machines can produce multiple strands up to 25 ft length.

The machines can handle practically all nonferrous metals and alloys, including aluminum, copper, nickel, zinc and their alloys. Molten metal is fed into the molds under automatic flow control,



maintaining a rate equivalent to the rate at which the solidifying castings move downward. Short mold lengths and high thermal conductivity facilitate rapid solidification of the metal. Molds, made of a special alloy, are internally cooled by water circulation.

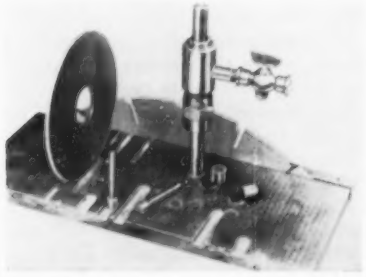
Lobeck Casting Processes Inc., 114 E. 32nd St., New York 16, N. Y.

T-3-1971

Diamond Cut-off Saw

A segmented diamond cut-off saw with a heat-resisting carbide matrix, was developed for sawing plastics, laminated Fibreglass, Mycalex and other hard and abrasive materials while withstanding frictional heat and wear occasioned by such sawing.

The blade, the 712C, cut ½ in. thick laminated Fibreglass at the rate of 1 ft



Roto-Finish

processes give you
• tremendous savings
• high production
• uniformity of finish

Savings on deburring, descaling, grinding, polishing, coloring and surface improvement by Roto-Finish barrel finishing processes are tremendous. Expensive hand finishing can be eliminated.

Results Guaranteed ! Send samples of finished and unfinished parts to Roto-Finish. Roto-Finish Sample Processing Laboratories will prove to you — before you buy — that Roto-Finishing will give you the results you want. Furthermore, Roto-Finish guarantees to produce the same results in your plant that are achieved in sample processing.

Let Us Help You with Your Problems

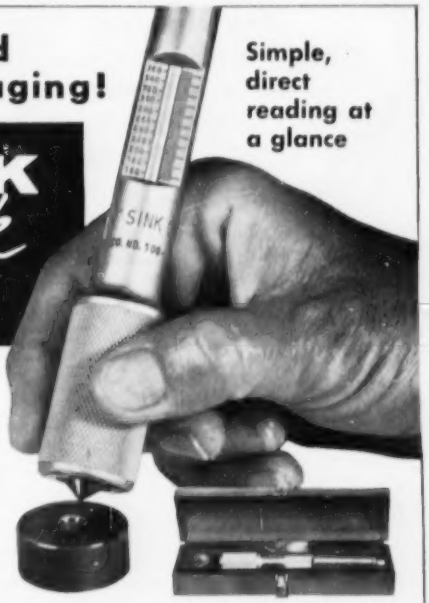
Roto-Finish COMPANY
P. O. Box 988
Phone FI 3-5578
3726 Milham Rd., Kalamazoo, Mich.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-197-1

Accurate, Rapid Countersink Gaging!

Simple, direct reading at a glance

TRULOK Countersink GAGE

This gage is an accurate high-precision instrument which requires no special skill or technique to use. The scale reading is direct with large .005" divisions, can easily be read within .001" tolerance. Made of HSS, in satin finish.



Set includes Calibration Block and handy Contour Gage for monitoring countersink drilling.

Trulok set is packaged in handsome, rugged, lined case.

The TRULOK is manufactured by TRIO PRODUCTS exclusively for

National Distributors
E. H. STAU CO.
351 S. Atlantic Blvd., Los Angeles, Cal.
AN. 3-3877

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-197-2

per 20 sec. at 3500 rpm, without appreciable wear.

Hollow-center diamond core drills also are successfully used on plastics and laminates. Half-inch diameter holes have been drilled in ½ in. thick laminated Fibreglass in 4 sec. at 3500 rpm.

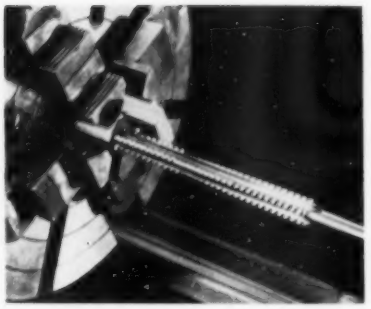
Mounted diamond points and DIT type diamond wheels mill and groove the same materials at high speed. All operations are run wet with water as the coolant.

Starlite Industries Inc., 58th and Market Sts., Philadelphia 39, Pa. **T-3-1981**

Threading Tool

This tandem style tap, called the Unipass, produces Acme threads of 10 to 30 deg included angle in a single pass in nuts 3 to 5 times as long as the thread diameter.

Roughing section of the tool has a thread with an included angle as great as 50 deg. With this design, threads can be relieved effectively and the wide flat Acme crest is absent, resulting in free-cutting characteristics. There is no risk of breakage by excessive torque or chip loading.



The last few threads on the roughing section function as a guide to the leads in the Acme finishing section. This finishing section corrects the angles and brings the thread up to size.

Because the starting threads serve as a pilot, leadscrew equipment is unnecessary while work may be done by unskilled operators. There is no need for reaming and thread tolerances are maintained on the starting threads of the nut.

Regal Div., Beloit Tool Corp., Beloit, Wis. **T-3-1982**

Centering Device

One-piece battery-powered center-finding device fits into a lathe chuck, drill press, jig bore or other machine and enables the operator to locate blueprint coordinates of the workpiece to an accuracy of 0.0003.

The unit, called the Wiggler, has a battery-powered electrical contact that

lights a bulb continuously when the work is properly positioned.

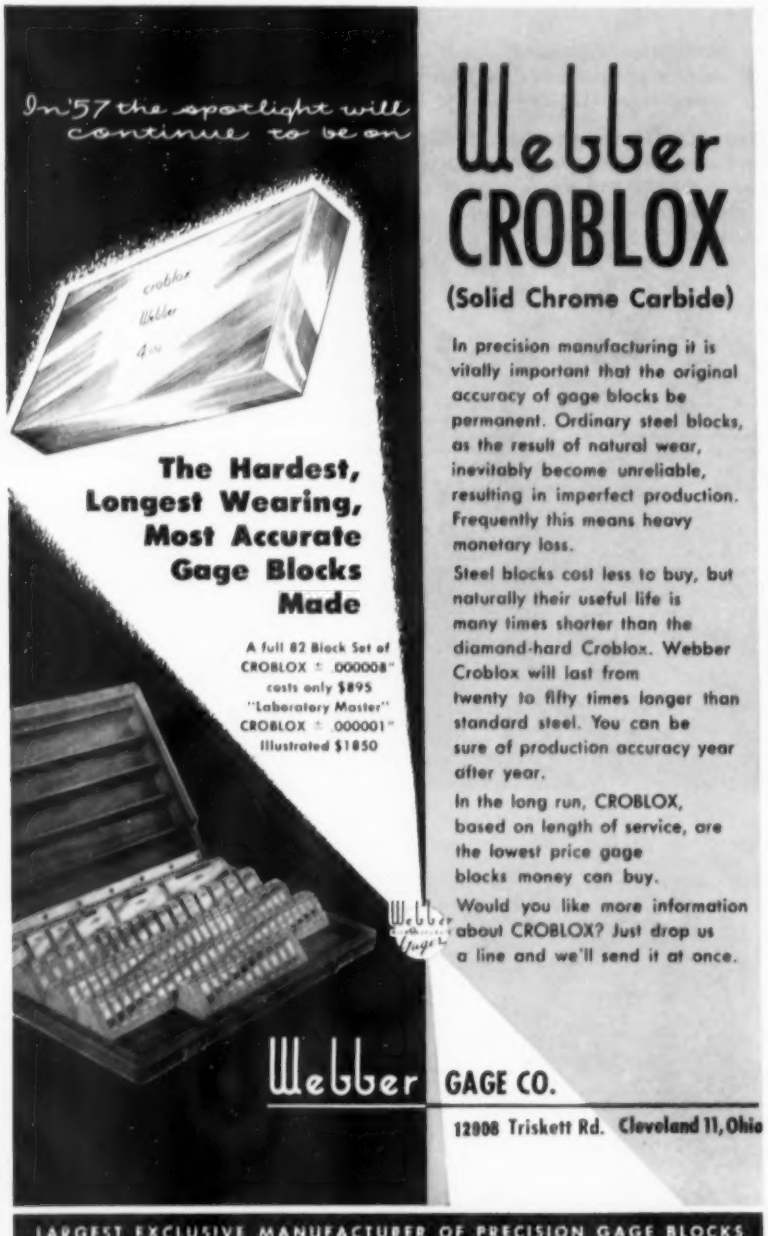
It is made of noncorrosive material that will not rust and provides long life. Standard batteries are used, and construction of the unit makes changes simple.

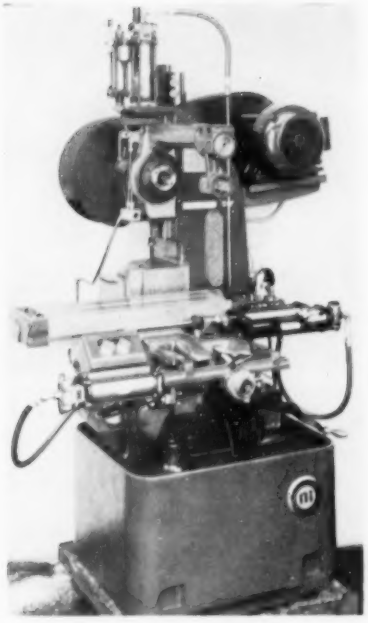
Armand Products, Inc., 20 West Morrill Ave., Columbus, Ohio. **T-3-1983**

High-Speed Milling Unit

High-speed automatic milling machines, suitable for slicing and dicing Germanium ingots for transistor manufacture, are of the rise-and-fall spindle type with speeds up to 10,000 rpm.

Automatic mist lubrication system is provided for spindle bearings and anti-friction overarm type arbor support. Diamond-impregnated sawing disks up to 8-in. diameter can be accommodated. Automatic transverse feed of 6 in., adjustable in increments from 0.001 to


In '57 the spotlight will continue to be on
Webber
CROBLOX
(Solid Chrome Carbide)
In precision manufacturing it is vitally important that the original accuracy of gage blocks be permanent. Ordinary steel blocks, as the result of natural wear, inevitably become unreliable, resulting in imperfect production. Frequently this means heavy monetary loss.
Steel blocks cost less to buy, but naturally their useful life is many times shorter than the diamond-hard Croblox. Webber Croblox will last from twenty to fifty times longer than standard steel. You can be sure of production accuracy year after year.
In the long run, CROBLOX, based on length of service, are the lowest price gage blocks money can buy.
Would you like more information about CROBLOX? Just drop us a line and we'll send it at once.
The Hardest, Longest Wearing, Most Accurate Gage Blocks Made
A full 82 Block Set of CROBLOX ± .000008" costs only $895
"Laboratory Master" CROBLOX ± .000001" Illustrated $1850
Webber GAGE CO.
12908 Triskett Rd. Cleveland 11, Ohio
LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS
USE FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-198



0.085 in., is synchronized with automatic pneumatic feeds of spindle head and table for high-speed continuous slicing cycles. All feeds are air actuated. Motors and all rotating members are precision-balanced to avoid vibration.

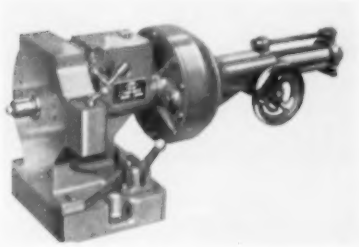
Made by W. H. Nichols Co. Distributed by The Robert E. Morris Co., West Hartford 7, Conn. **T-3-1991**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Boring Unit

Model C-4 precision borer, called the Hydro-Borer, achieves tolerance of ± 0.003 in. and finishes to 30 microinches.

Because the Model C-4 can be mounted on any type of base, its pre-



cision boring ability can be built into production setups. Fixtures can be mounted directly on the face, 90 deg to the spindle. An automatic trip and spindle return are furnished as optional equipment.

Spidle diameter is 1¼ in. with a #2 Morse taper. The taper can be supplied either concentric or eccentric. Eccentric taper permits increasing bore diameter a total of 0.014 in. in increments of 0.001 without resetting the tool bit.

Feed, through a patented principle of oil displacement, is available in one of two ranges: either 0.002 to 0.004 in. or 0.0035 to 0.007 in. It feeds in either direction by reversing rotation and has an adjustable stop in either direction. The oil reservoir is cast integrally with the main housing.

Greenlee Bros. & Co., Rockford, Illinois. **T-3-1992**

Hole Locating Attachment

Used in standard punch presses, with standard punches, the Lo-Ka-Tor locates and punches holes without the use of stops, fingers, gages, pins or locating tables. The tool simplifies hole-locating problems in sheet metal punching when quantities are very small, as in prototype work and template making.

One hand control lowers or raises the punch to the workpiece, independent of the ram of the press, allowing alignment of punch and hole location in the

The new concept of vertical measurement is here
Webber Micro-Accurate
OPTICAL HEIGHT GAGE
This revolutionary new instrument will make micro measurements in the 1" to 61" range with an hitherto unknown overall accuracy of ± .000005" per inch.
These fantastic measurements are made speedily and easily by the average skilled workman.
Next to your Gage Blocks the new Webber Optical Height Gage will be the most useful tool in your shop. There is nothing like it in all the world.
Webber GAGE CO.
12908 Triskett Rd., Cleveland 11, Ohio
Webber Micro-Accurate Gages
LARGEST EXCLUSIVE MANUFACTURER
OF PRECISION GAGE BLOCKS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-199

Saves 40% Space!

STRONGER, TOO

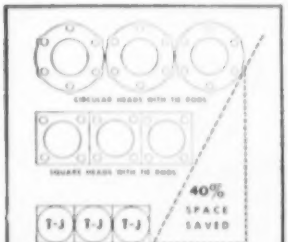
Than Outmoded
Tie Rod Cylinders!

Only T-J

Spacemaker CYLINDERS

Offer All The Extras As Standard!

- NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Compact design eliminates tie rods, saves up to 40% space
- Proven Performance . . . with Extra High Safety Factor
- Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost)
- OIL pressure up to 750—AIR to 200 P.S.I.



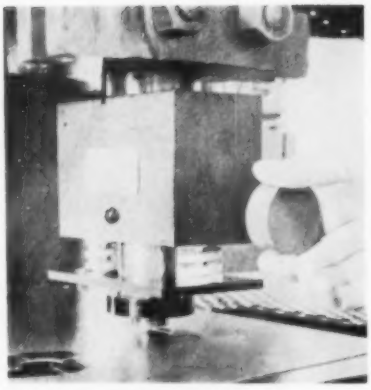
NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J TOMKINS-JOHNSON
VALVES · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-200



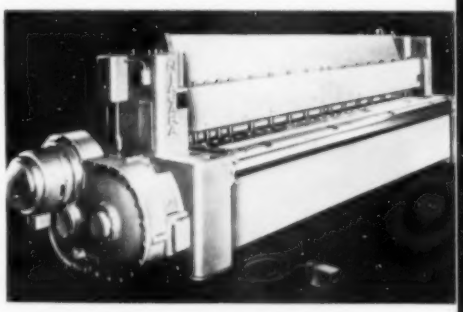
workpiece before tripping the press. When the press is tripped, the Lo-Ka-Tor automatically punches the hole, locks the punch for the upward stroke, and strips the workpiece.

Model 183A has a capacity of 0 to 1½-in. hole in ⅛-in. mild steel, or 0 to 2½-in. hole in 14 ga mild steel. Available with standard shanks, it fits any press having a stroke not over 3 in., and having at least 6 in. of shut height.

Buck Engineering Co., Inc., 37-41 March St., Freehold, N. J. **T-3-2001**

Power Squaring Shears

Line of underdrive squaring shears has been improved with added features and optional accessories. A hinged-back gage angle, which can be swung out of the way when not needed, permits long plates to be fed through the shear. An adjustable, parallel micrometer back gage allows fast, precise settings for cutting blanks or strips



without use of rules or wrenches. A light beam shearing gage is installed in the correct focus to cast a sharp shadow line for shearing angular and irregular shapes to scribed lines. Disappearing adjustable stops permit feeding sheets without lifting and without risk of marring.

Other new features are a remote-control electric foot switch and a safety guard that remains stationary while the

holddown engages the work.

The underdrive shear line embraces 59 models with capacities ranging from 16 ga to 1-in. mild steel, and cutting lengths from 4 to 20 ft.

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. **T-3-2011**

Plastic Industrial Wheel

The Lamilon nylon-reinforced all-plastic industrial wheels have unusually high impact strength and abrasion resistance. They will not mark wood floors or mar concrete and similar type floors. They have low water absorption, high resistance to greases or chemicals, and are not affected by elevated temperatures. In addition, the wheels are sparkproof and have high load ratings.

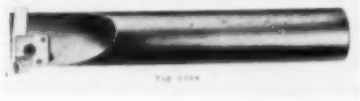
They are regularly furnished in 3 through 12 in. diam., and have alloy steel roller bearings with hardened steel outer races and provision for pressure lubrication.

The Fairbanks Co., 393 Lafayette, New York, N. Y. **T-3-2012**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Boring Bar

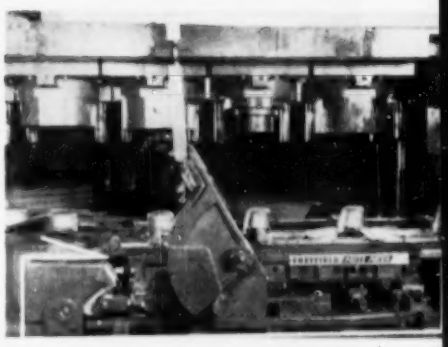
A boring bar, for use on turret lathes, boring mills, etc. incorporates a triangular shaped tool bit and an infinitely adjustable, solid carbide chip breaker to provide positive chip control. An adjusting setscrew behind chip breaker



permits quick, easy adjustments for various feeds and depths of cut and reduces risk of tool bit breakage. Wedge-action clamping of the tool distributes the clamping pressure over a wider bit area, assuring rigidity and positive setting.

Everede Tool Co., 2001 N. Parkside Ave., Chicago 39, Ill. **T-3-2013**

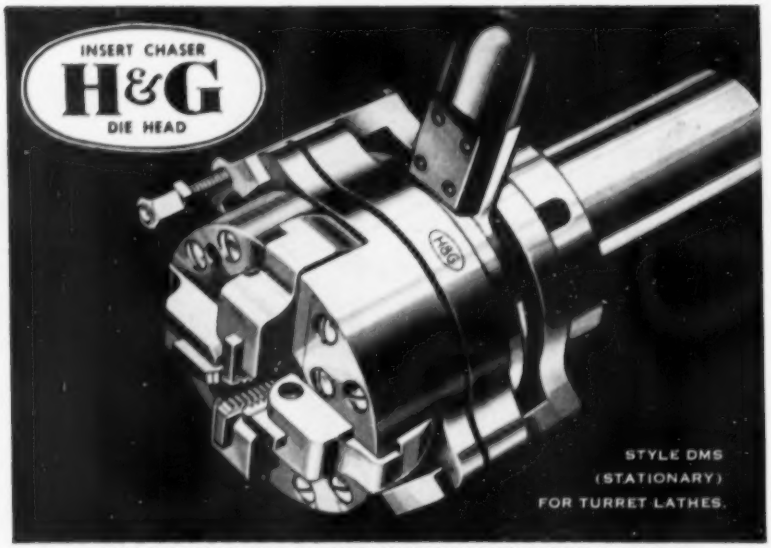
Portable Transfer Unit



This portable mechanical transfer unit may be used to convert any standard press into an automatic press capable of handling a number of progressive operations and a broad range of part sizes.

The unit, called the Press Pacer, will either transfer stampings from one die station to the next on each stroke of the ram or transfer parts between presses. There are no electrical, pneumatic, or hydraulic connections or

FOR INCREASED EFFICIENCY IN +GF+ COPYING TURNING
1 Coromant Gives You ECONOMY
The insert in the Coromant Copying Lathe Tool is rhomboid shaped. It is ⅛" thick but its special shape gives it a ¾" length of cutting edge.
2 Coromant Gives You RIGIDITY
The design of the Coromant holder gives unsurpassed rigidity which permits high feeds. The tool shank is heat treated to provide high tensile strength which insures rigidity. The insert has a full, solid back support almost up to the point.
Feed .030
3 Coromant Gives You SUPER WEAR-RESISTANCE
Coromant carbide's resistance to wear and cratering is a result of the basic purity of raw materials, intensive metallurgical research and development plus close, unified control by Sandvik Coromant from the ore to the finished tool.
USE THE SANDVIK Coromant COPYING LATHE TOOL
58° Included Angle
3° Lead Angle (also available with 1° lead angle)
Carbide
FREE CATALOG
COVERS COMPLETE COROMANT LINE OF TOOLS BLANKS & INSERTS
* Includes wide variety of tools and blanks for turning, boring, facing, threading and grooving. Tools, cutters, drills, reamers, scrapers, Swiss-type automatic tools, etc.
* In an unusually wide range of standard shapes and angles.
* In all standard grades to suit a wide range of applications.
Coromant Division
SANDVIK STEEL, INC.
1702 Nevins Road • Fair Lawn, N. J.
Fair Lawn 4-6200 — In N. Y. C. Algonquin 5-2200
CLEVELAND
8650 Brookpark Rd., Cleveland 29, O. — Ohiorio 1-3265
CHICAGO
230 North Michigan Ave., Chicago 1, Ill. — FRanklin 2-5638
DETROIT
14131 Puritan Ave., Detroit 27, Mich. — BRoadway 3-6474
LOS ANGELES
3338 South Mail Ave., Los Angeles 22, Cal. — RAymond 3-9116
SANDVIK CANADIAN LTD.
P. O. Drawer 1330, Station O, Montreal 9, P. Q.
FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY
SS-121
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-201



STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

This die head is unique

THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for less than $45 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

FOR FURTHER INORMATION, USE READER SERVICE CARD; INDICATE A-3-202-1

IT'S POWRARM RIGHT DOWN THE LINE

. . . At Power Products Co., Grafton, Wis.

Wilton PowRarms, placed every two feet on a 100' long conveyor, help Power Products Corporation assemble six gasoline engine models on a single line. PowRarms, which can be moved to any angle in all three planes, and locked in position, enable operators to adjust work pieces to any convenient angle of approach. The result is an exceptionally high rate of production on all models. PowRarms come in a wide range of automatic and manual models.

Attach this ad to your letterhead for a free demonstration or literature!

WILTON Tool Mfg. Co., Inc.

SCHILLER PARK, ILLINOIS

Sold By Leading Distributors The World Over

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-202-2

movements.

The Press Pacer is adjustable for different spacings between dies and also for different ram strokes. It can be installed to run either front-to-back or left-to-right. The unit is bolted to the bed of the press.

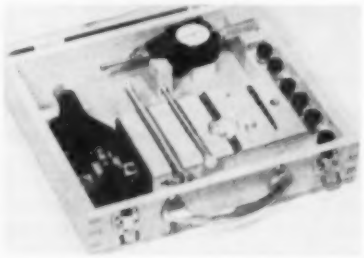
The minimum size press in which the standard model can be used has a bed area approximately 42 x 72 in. and a 14-in. shut height. The standard model has a stroke adjustment up to 12 in. and a transfer distance adjustable to any increment within the 8 to 36-in. range.

The Sheffield Corp., Dayton 1, Ohio.

T-3-2021

Dial Gages

Three dial bore gages, with indicator readings to 0.0001 in. are offered in the Tri-O-Set. The gages, which cover the range of ⅛ to ¼ in., ¼ to ½ in., and ½ to 1 in., are quickly interchangeable, and require only 10 extensions to cover



the entire range; they have fixed equalizers from ¼ to 1 in.

An additional item in the kit is the Setmaster, which does the job that master rings ordinarily do, and masters the three dial bore gages to any dimension within a range of 0 to 1 in. The Setmaster can be set with wires or gage blocks.

Boice Gages, Inc., Hyde Park, N. Y.

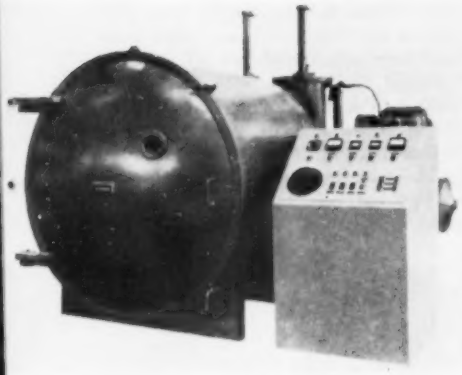
T-3-2022

Vacuum Metallizing Unit

Model 427 72-in. large-scale production vacuum metallizing unit has a redesigned vacuum pumping system which achieves faster evacuation of the chamber, permitting shorter metallizing cycles and increased productivity. The pumping system has been simplified through use of fewer but larger capacity diffusion pumps.

There are two 16-in. Ring-Jet diffusion pumps and a 6-in. Ring-Jet booster pump which backs up the diffusion pumps.

As a result, pump-down time to 0.5 microns has been reduced to six minutes or less and the pumping system is able



to handle unusual operating conditions.

Solenoid-controlled air-operated poppet valves installed in the vacuum manifold are all remotely operated from the control console located at the front of the unit.

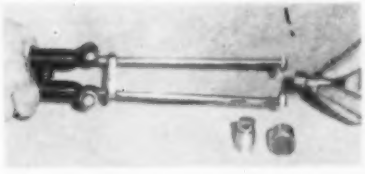
High Vacuum Equipment Div., F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **T-3-2031**

Hand Torch With Interchangeable Heads

Gas-oxygen hand torches are designed with three interchangeable tips for different applications in the glassworking and metalworking fields.

When the handles are squeezed, the tip drops out, and can be replaced by inserting the new tip between the prongs. The tip can be tilted freely to any angle.

Constructed on the principle of the Polymix flame, the InstoChange hand



torch has unusual heat volume and noiseless operation, due to a thorough mixture of gases and absence of turbulence.

There are no cold spots in the flame, and flashback is impossible even when the gas or the oxygen valves are shut off abruptly. Combustion is complete and firechecks are said to be unnecessary.

InstoChange torch burns gas at ordinary city pressures. It will burn manufactured or natural gas, as well as hydrogen, propane and other gases. With any of these gases, the three tips work hard glass tubings up to 85 mm in diam.

Burner heads may be swiveled to any angle so heat is applied precisely where needed. Thumb control of two valves, one admitting gas and one oxygen, permits accurate flame adjustment. By use of different tips, the flame may be changed from a small, sharp flame of one or two inches in length to a wide flame 18 in. log.

The torch is 13½ inches long. Weight is 10 oz for the holder plus ½ oz for the small burner head, 1 oz for the medium head and 1½ oz for the large head.

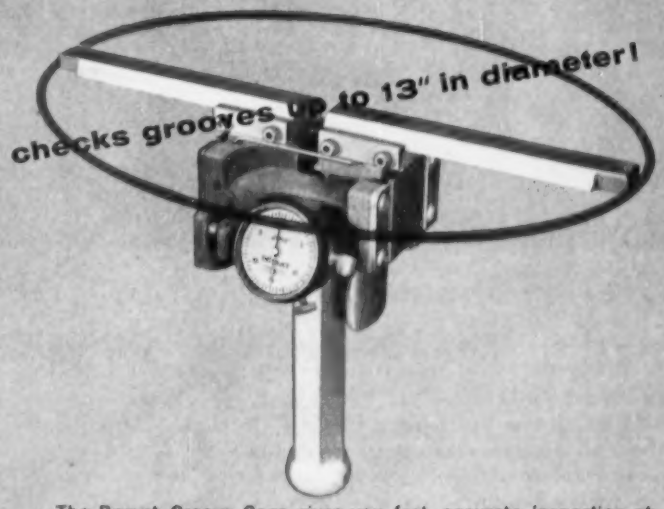
Bethlehem Apparatus Co., Hellertown, Pa. **T-3-2032**

Planishing Unit

Roll planisher features rotating heads that can be turned 90 deg and locked in position for planishing either circumferential or longitudinal welds on tubes, tanks, cones and other shapes. Vise type locks hold the upper and lower heads in position.

This 6½-ton planisher has a 72 in. throat. Pressures up to 10 tons and throat depths up to 96 in. are available. The upper head is power driven by geared-head motor and chain drive. There are no size limitations for large

BRYANT GROOVE GAGE



The Bryant Groove Gage gives you fast, accurate inspection at low cost. With long segments, as shown, you can measure grooves up to 13" in diameter.

The standard Bryant Groove Gage kit includes four pairs of segments to check "O" ring grooves through 5" dia. and four pairs of segments to check snap ring grooves through 5" dia. Immediate delivery from stock.

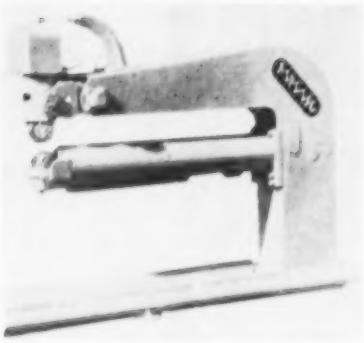
Also available: Bryant bench gages to measure internal threads, external threads, concentricity and squareness of face, and portable gages for checking internal threads. Write for complete information.

Bryant Gage & Spindle Division

P. O. Box 620-J, SPRINGFIELD, VERMONT

Division of Bryant Chucking Grinder Company

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-203



diameter tubes. For small diameters, a traveling backup attachment is supplied.

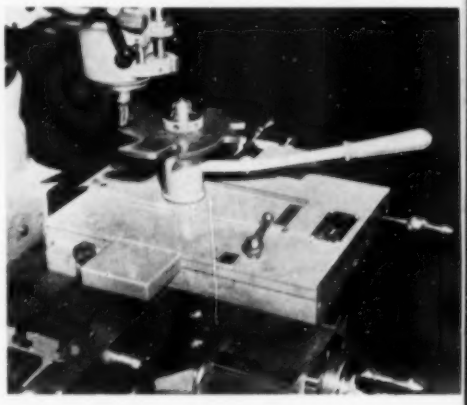
Airline Welding & Engineering Co., 785 N. Prairie Ave., Hawthorne, Calif. **T-3-2041**

Cam Generator

The Gen-A-Cam precision cam generator may be used with either a milling machine or surface grinder to produce accurate and constant rises on all plate cams. It will alter hardened cams within minutes during setup and restore soft cams that have worn from the heavy pressure of cam rollers.

Lobes of any size may be created while two or more rates of rise can be generated on any one lobe, permitting two or more rates of feed for any tool.

The tool, operating without use of change gears, is accurate with an infinite selection of rates of rise from



dwell to 0.100-in. rise per hundredth of cam surface. Graduations may be either in degrees or hundredths.

A layout attachment is available which allows quick accurate scribing of cam blanks.

Steuby Mfg. Co., St. Louis 13, Mo. **T-3-2042**

Hollow Shank Boring Bar

A hollow shank in the "W" boring bar permits coolant to travel the length of the bar. It is sprayed directly on top of the cutting edge through an adjustable nozzle for effective cooling of

cutter and material. As a result, heavier cuts can be taken at higher speeds.

Available with shank diameters of ¾, ⅞, 15/16 and 1½ in., the W bar is used with detachable cutter heads in three sizes—for boring, facing and internal threading. They may be had in high-speed steel or carbide tipped.

R. B. Tool Co., Inc., 785 N. Broadway, White Plains, N. Y. **T-3-2043**

WHY . . . Should You Measure To MILLIONTHS OF AN INCH?

All gaging authorities agree that it is necessary to gage to an accuracy 10 TIMES GREATER than the desired working tolerance. Therefore, if your tolerances are .002" or less, you should use a gage accurate to 20 millionths of an inch or less to assure proper dimensional control. Measurement methods and equipment used in many plants for such tolerances cannot be relied on for this accuracy.

Industry is finding the electronic indicator not only more accurate and repeatable, but also less subject to damage than many other types of gaging equipment. In addition, its simplicity of operation enables any operator, who can use a dial indicator or micrometer properly, to measure accurately to millionths of an inch.

Simple And Easy To Read To MILLIONTHS OF AN INCH . . .

The INDI-AC ELECTRONIC INDICATOR is merely set to the required dimension with standard gage blocks. The parts to be gaged are then placed under the gage tip and the meter indicates the variations from the desired dimension MAGNIFIED UP TO 10,000 TIMES! Thus it is far simpler and easier to read than a dial indicator or micrometer.

This versatile instrument is used for all gaging purposes such as surface plate or height gage work, checking setups, runout or alignment of parts or machines.

Using the INDI-AC, the tolerances which you now estimate will be easy to work to and measure.

WRITE for further details on the *new* INDI-AC and other Electronic Production Gages, TODAY!

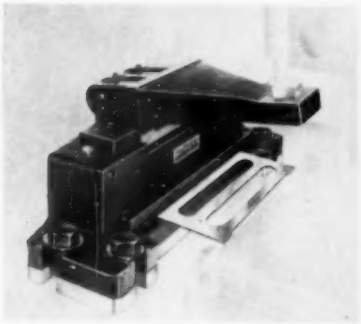
Cleveland INSTRUMENT COMPANY, INC.
733 Carnegie Avenue • Cleveland 15, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-204

Scrap Chopper

Steel up to 12 in. wide and approximately $\frac{3}{32}$ in. thick solid cross section can be handled by this low-cost, 12-in. scrap chopper. The unit is driven by the punch press ram, independent of the die.

This scrap chopper is easily installed. It fits any punch press and handles any



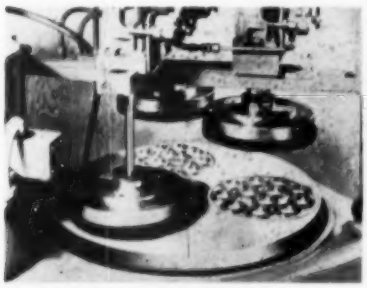
coiled ribbon stock. Scrap falls directly into a container, minimizing handling and providing safety for personnel. Blades can be removed quickly for grinding, and spare blade can be installed quickly.

Jaco Devices, Inc., 101 High St., Hingham, Mass. **T-3-2051**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Polishing Equipment

Production polishing accessories and equipment are designed to convert Model 24 Lapmaster lapping machine into a high speed polishing unit. Thus equipped, it will handle polishing re-



quirements of all types of materials at a high production rate.

Tooling consists of a special lap plate and pneumatic lifts. Sponge-neoprene pads are also added to the pressure plates, as well as polishing-paper disks and double-sided sensitive tape for mounting the polishing paper to the lap plate. Conversion is easily

Let us take over your inventory problem!

Immediate Delivery

ANY BORE SIZE • ANY MOUNT • ANY STROKE

CARTER CYLINDERS

Sounds too good to be true, but here's real help for engineers and designers who need fast action on cylinders. Carter's exclusive key type locking design and simplicity of parts *makes it possible to ship cylinder orders in 24 hours or less!* Now you can have rugged, dependable, compact quality cylinders when you want them. We produce around the clock. Your order is in process *minutes after we get it.*

Service on spare parts is good too! Experienced engineers and parts stocks are located in 40 different locations in the U. S., Canada and Mexico.

PHONE SERVICE 24 HOURS A DAY

Orders taken day or night. If you need fast service call your Carter representative or the plant: LANSING, ILLINOIS, GRanite 4-3305 or CHICAGO, BAyport 1-7186. Teletype LNSG, ILL 1119X

Complete Catalog File!

Complete bound file with ordering details for: Air Cylinders; 750 Lb. Hydraulic; 1500 Lb. Hydraulic; Clamp Cylinders; Air Valves; Built-in Valve Type Cylinders. Complete with parts data, specifications and prices. Send today!

CARTER CONTROLS INCORPORATED

2972 Bernice Road • Lansing, Illinois (Chicago Suburb)

AIR CYLINDERS • HYDRAULIC CYLINDERS • AIR VALVES
ROTARY ACTUATORS • SPECIAL CONTROLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-205

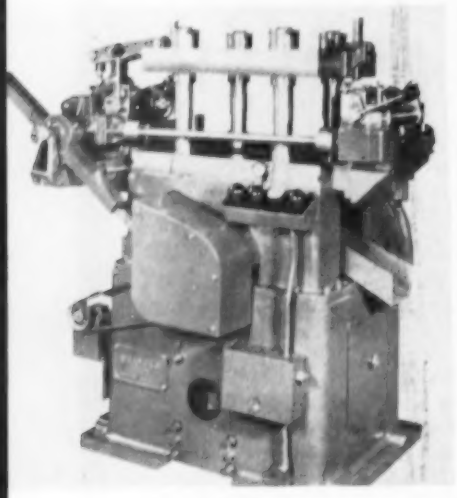
accomplished in the plant.

With 4/0 polishing paper, the machine achieves a high production rate without generating heat to distort parts. Flatness can ordinarily be held under 3 light bands.

Crane Packing Co., Dept. TED, 6400 Oakton St., Morton Grove, Ill. **T-3-2061**

Automatic Press

Speeds up to 500 strokes per minute are provided by this 30-ton automatic press. Design features include air counterbalance, counter balanced crank shaft, and low center of gravity. Draw rods are guided above and below crank



shaft. A coil feed mechanism provides accuracy at high speeds.

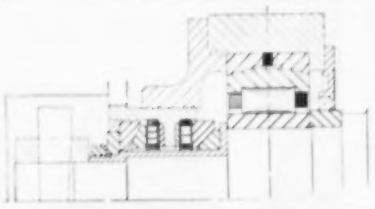
This press, which is particularly useful in blanking large quantities of small parts, is 64 in. high. Standard die area is 10 x 31 in. It also is available in a double-throw model with die area 30 x 31 in.

The Brandes Press Co., 6408 Euclid Ave., Cleveland 3, Ohio **T-3-2062**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Thrust Bearing

Type DAT double-acting aligning thrust bearing (at center in the illustration) is designed for severe conditions where potential misalignment and heavy but intermittent thrust loads from either direction are present. In assembly for steel forming passes, it consists of two center thrust plates, two roller assemblies, a left-hand convex-curved thrust plate with concave-curved aligning plate, a right-hand concave-curved thrust plate with convex-curved aligning plate, and an inner spacer sleeve.



One-inch diameter rollers are staggered to assure equal wear distribution. Bearing thrust capacity, at 100 rpm, is 114,275 lb.

This bearing is used in conjunction with specially designed aligning radial roller bearing. Bearing's straight inner race is separable, with roller assembly self-contained in outer race. Outside diameter of double-flanged outer race is concave for alignment with convex surface of aligning ring. Capacity of special MUC type radial bearing is 278,800 lb at 100 rpm.

Rollway Bearing Co., 541 Seymour St., Syracuse, N. Y. **T-3-2063**

Hot Work Die Steel

A high chromium steel called Jet Forge, offers toughness and high wear resistance on the high temperature applications involved in forging jet parts. The new hot-work die steel also has excellent resistance to heat checking, which improves die life.

The tool steel is available from stock as bars, billets, disks and forgings.

Vanadium Alloys Steel Co., Latrobe, Pa. **T-3-2064**

Tape-Controlled Positioning Table

This automatic table for use with existing machine tools having automatic spindles, is a portable precision machine that is simple to operate and requires no special operator training.

Table motion, controlled by magnetic tape, is in a horizontal plane. Travel at 45-deg angles to the perpendicular axes is produced by electrically connecting the two axes during recording. Range of motion is 20 x 10 in., and accuracies of ± 0.001 in. are obtained. Maximum table thrust is 1000 lb. Overall table dimensions are 50 x 35 x 15 in. high, and console dimensions are 22 x 19½ x 48 in. high.

Because the operator only places a blank on the machine and starts the sequence for each part (when recording is complete), one unskilled operator can run several machines. Table motion and speed are continuously controlled, and milling can be done in addition to stationary part operations.

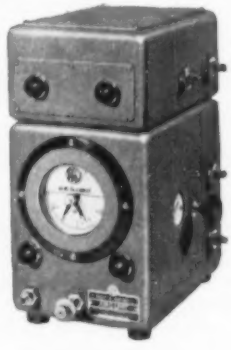
To make matching right and left-

BUILD A GAGE INSTALLATION TO SUIT YOUR NEEDS . . .

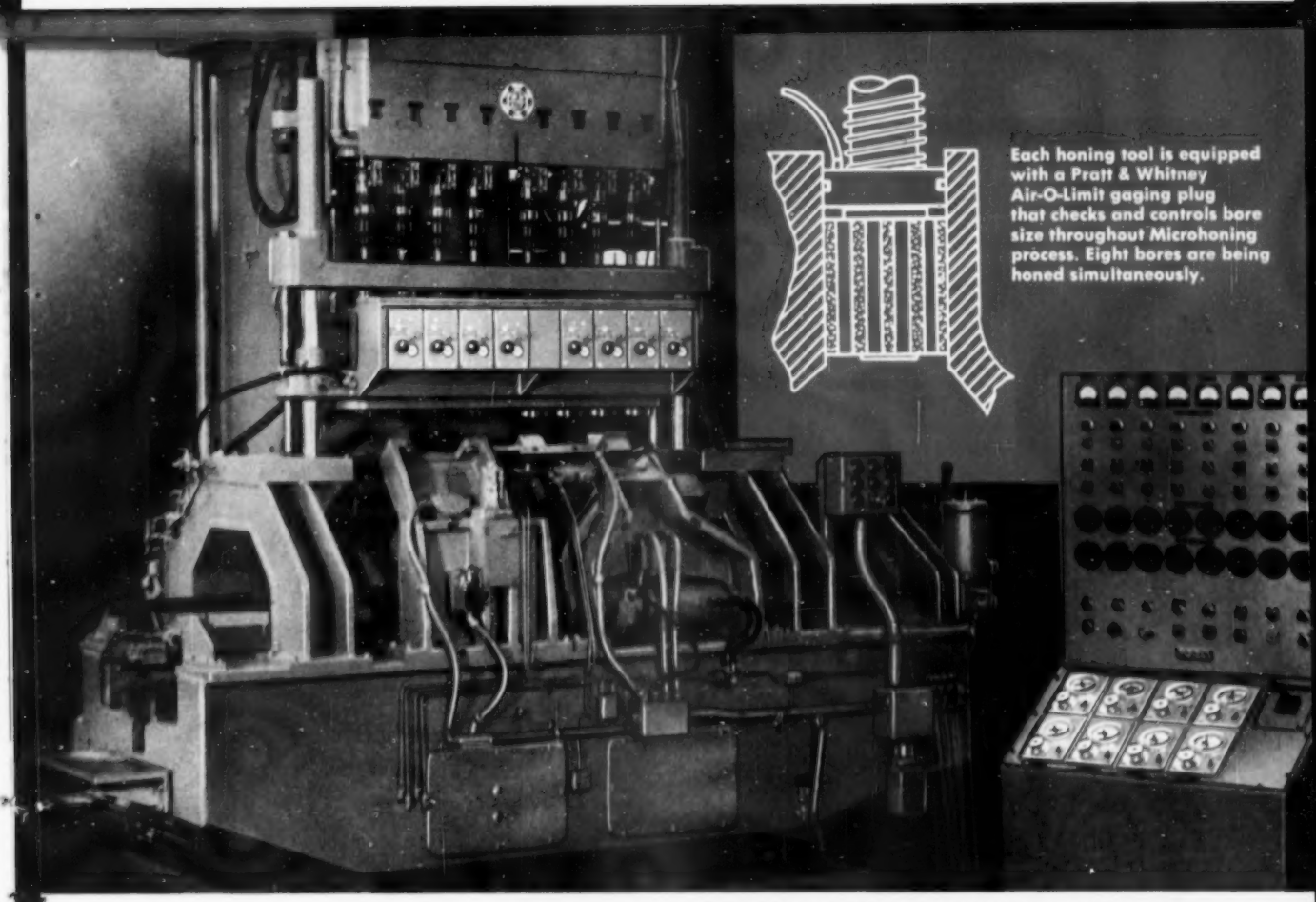
with these packaged, on-the-shelf P&W Air-O-Limit Light Signal Units. Can be used to signal operator or to provide feed-back impulse for fully automatic process control.

BASIC 2-LIMIT UNIT . . . indicates high and low tolerances. Suitable for sorting and other "yes-or-no" control applications.

3-LIMIT UNIT . . . especially suited for grinding and similar operations. Indicates or automatically controls such conditions as: "Fast Feed," "Slow Feed," and "Spark-Out."



4-LIMIT UNIT . . . similar to 3-Limit Unit, but provides greater control scope. Indicates or controls such conditions as: "Approach High Limit," "High Limit," "Approach Low Limit" and "Low Limit."



Each honing tool is equipped with a Pratt & Whitney Air-O-Limit gaging plug that checks and controls bore size throughout Microhoning process. Eight bores are being honed simultaneously.

PHOTO COURTESY OF MICROMATIC HONE CORPORATION, DETROIT, MICH.

Make Your Investment in Precision Pay Off in PRODUCTION

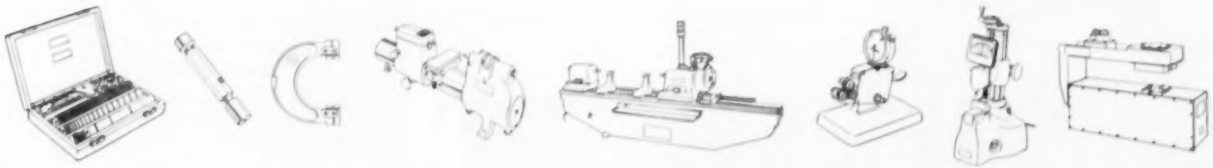
• • • WITH PRATT & WHITNEY "PACKAGED" AUTOMATION GAGE UNITS

Applied to your precision production machines, "P&W Automation Gaging" will make it possible for you to increase production, reduce scrap losses and put to work more effectively the high precision built into your equipment. And in addition, the use of Pratt & Whitney standard, on-the-shelf Packaged Gage Units will provide an installation *custom-tailored* to your exact needs *WITHOUT* the expense and delays involved in engineering and constructing special controls.

In this example – a Micromatic Hydrohoner – automotive cylinder blocks are gaged *during* the Microhoning process. When final size is reached, the machine is automatically shut off and the Microhoning tools are retracted. A change to a different bore size can be made, without stopping the machine, by a simple adjustment on a calibrated gage control dial. Visual indication is given of the accuracy of the new adjustment. Cylinder blocks are produced at a rate of 120 per hour. Reject and scrap losses are virtually eliminated.

Make the most of *your* investment . . . make it a point to call in a P&W Field Engineer to analyze your production requirements and recommend the right P&W Automation Gaging installation to help you increase output, improve accuracy and reduce reject losses.

Pratt & Whitney Company, Incorporated,
16 Charter Oak Boulevard, West Hartford, Connecticut.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

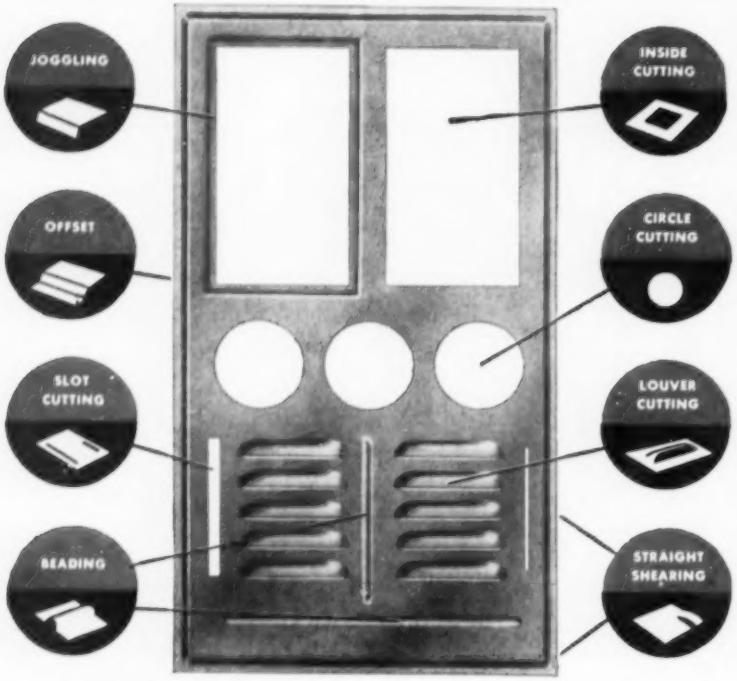
PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

PULLMAX METALWORKING IDEAS

Expensive dies eliminated with standard Pullmax Tools

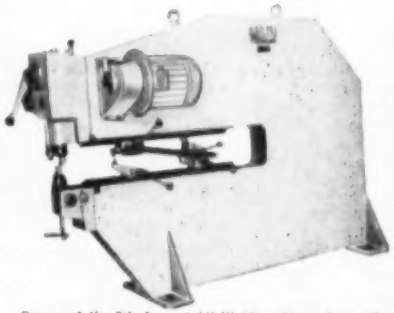


This instrument panel board made complete on a PULLMAX

Only the Pullmax universal shearing and forming machine has the versatility to do all of the metalworking jobs in your Model Shop, Engineering or Maintenance Departments.

This one versatile machine does straight shearing, inside or outside circle cutting, design cutting, inside square cutting, beading, joggling, slot cutting, louver cutting, dishing, edge bending and flanging.

7 sizes of machines cut up to 1¼" in mild steel. Ask for a demonstration right in your plant.



See us at the 5th Annual All-Welding Show, Convention Hall, Philadelphia, Pa., April 9-12. Booth No. 500.

AMERICAN PULLMAX CO., INC.
2451 N. Sheffield Ave., Chicago 14, Ill.

MORE MONEY-SAVING METALWORKING IDEAS ARE YOURS IN THIS *FREE* BOOKLET

Please send us the Pullmax Catalog on Money-Saving Metalworking Ideas.

COMPANY _____

STREET _____

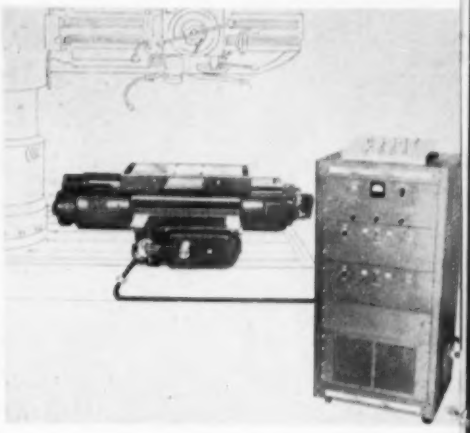
CITY _____ ZONE _____ STATE _____

NAME _____ TITLE _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-208

hand parts from a single recording, switches have been provided to reverse all movements of either axis. Control switches allow the operator to stop the automatic sequence at any time to inspect drill sharpness, depth setting, etc. Another switch permits automatic restart of the tape immediately after rewind for making a series of small parts strung out along the table top.

The tape handler accommodates reels up to 14 in. in diameter, or enough recorded information to produce 40 minutes of table running time.



The system uses ½-inch magnetic tape on which seven channels of information are recorded. Four of these produce table motion; one stops the tape during machining; one controls spindle movements of the machine to which the table is attached; and one rewinds the tape when a part is finished. Although most recording is done by manual operation of the table, tapes can be prepared for milling circles, arcs, and odd shapes by using special recording equipment.

The system is adaptable to almost any machine tool.

Allison Equipment Co., 710 Wilshire Blvd., Santa Monica, Calif. **T-3-2081**

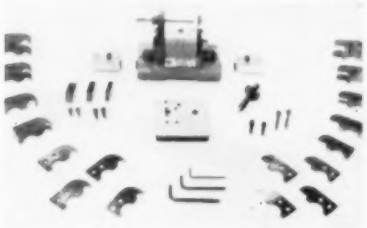
Universal Staging Unit

A wide range of projection gaging applications can be accommodated by this Multi-Stage unit. With its compact assortment of hardened and ground precision inserts, the many possible combinations of components can be quickly arranged to satisfy even intricate location requirements.

Special locking keys permit use of this base units as a shifting or traveling unit, and parts up to 4 in. long can be gaged. Stop components are inserted in comparator table slot at a predetermined spacing, making it possible to progressively view the entire length of

a part in conjunction with a superimposed chart layout.

All parts are interchangeable and identified by numbers. All V-type inserts permit staging cylindrical parts from $\frac{1}{32}$ to $\frac{1}{2}$-in. diam, while shelf type inserts accommodate a wide range of flat or odd-shaped parts. No changes



are necessary in the clamp adjustment, except for lateral position sometimes needed to establish most desirable balance condition on long or heavy parts.

The standard kit includes a ground work plate and a rotary locating spindle that mounts directly in the fixture base. This spindle incorporates a V locator in one end and a magnet locator in the opposite end.

Automation Gages, Inc., Sibley Tower Bldg., Rochester, N. Y. **T-3-2091**

Magnetic Drill Press with Automatic Feed

The electromagnetic base of this portable drill press holds the tool in position while the power feed makes it possible for the operator to run the drill point down to the center punch mark and turn on the automatic feed, which runs the drill into the work.

Power feed can be engaged or disengaged at any time during the drilling

operation, and the depth of cut per revolution can be set according to the size of drill bit used.

In continuous drilling operations the power feed Portomag will drill up to $1\frac{1}{4}$ in. and tap 1-in. holes accurately.

Portomag, Inc., 1511 E. Nine Mile Rd., Ferndale 20, Mich. **T-3-2092**

Contact Wheel

Contact wheel for grinding with coated abrasive bands consists of a metal core and replaceable rubber segments. Worn or damaged segments can

be replaced singly or in groups; the core never needs to be replaced.

Segments are available in a variety of hardnesses and can be used in any combination to attain different cutting actions. A fast cutting action might be achieved by using hard segments and soft segments in alternate slots.

Design of the wheel is such that complete peripheral contact is made with the coated abrasive band, providing high holding power. Each segment is anchored in the metal core by a key slot and cannot fly off the wheel even if the abrasive band ruptures.

Wheel diameters of 3, 4, 5 and 6 in. are included in this line. Widths are made to any specification. Standard segments are made to full width of the wheel, but fractional-size segments can be provided for contouring use.

Nu-Matic Grinders, Inc., 8224 Carnegie Ave., Cleveland 3, Ohio.

T-3-2093

Stainless Actuator

Designed to operate within a temperature range from −67 to +600 F, this all-stainless steel actuator is hydraulically operated over a range of pressures from 0 to 3000 psi. It also can be adapted to pneumatic operation.

Prototypes have a stroke of 7 in. They are 16 in. long and $2\frac{3}{8}$ in. in

IDEAL GOLD BAND
LIVE CENTERS
GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS
PRECISION FITTED BEARINGS
Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.
A COMPLETE LINE FOR EVERY NEED...SPECIALS, TOO!
In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today...or
Send for
Complete catalog data and specifications.
IDEAL INDUSTRIES, Inc.
4152-C Park Ave., Sycamore, Ill.
DISTRIBUTED BY THE NATION'S LEADING INDUSTRIAL DISTRIBUTORS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-209

diameter.

Basic design of the actuator can be altered to suit specific performance and space envelop requirements. The actuator uses no O-rings and is designed to incorporate high temperature seals.

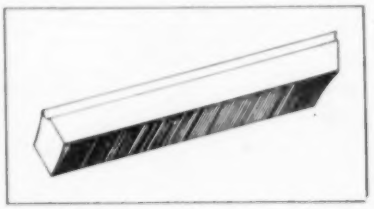
Aircraft Div., Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

T-3-2101

Tool Bits

In these Universal Preground Tool Bits, chip grooves and side clearances are hollow ground the full length of the tools. Ends are correctly beveled to provide either a right or left-hand turning or facing tool. Because wear and dulling take place only on the tip of the tool, only the end must be reground, following the original angle. Regrinding can be done quickly and accurately, even by the inexperienced operator.

They are available in two grades. Economy-grade bits are ground from hardened high-speed tool steel. They are recommended for production machining of softer materials. Industrial-grade bits are ground from a high grade of cobalt tool steel, making them suitable for difficult materials in either toolroom or production work.



Tool-Craft Co., 109 Harvey St., Hackettstown, N. J. **T-3-2102**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Colored Safety Hardeners For Epoxy Resins

With these colored safety hardeners, it is now possible to add hardness to an Epocast epoxy resin and determine from visual inspection whether or not thorough and adequate mixing has taken place. Striations, streaks, and uneven color distribution indicate improper mixing. Colors aid part identification and provide a permanent attractive appearance.

The hardeners are practical for coded identification and service of cast and laminated plastic tools such as: colored sealants on pipes to aid identification and inspection; identification and appearance of epoxy potting compounds; and for integrally colored structures, which do not require painting. Red, blue, yellow, green, orange and black colors are available.

Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif. **T-3-2103**

Test Indicator

Check Master test indicator is available in six models, including nonmagnetic types. It responds to dimensional variations of 0.000020 in.; repeats without visible error and can be used on all types of fixtures, surface plate setups and for truing work on machines. It is available with 1⅛ or 1¾-in. dials,

WE'VE SWITCHED TO PIONEER 921-T CAST ALUMINUM TOOLING PLATE. IT'S ALWAYS AVAILABLE IN SIZES CAST TO SUIT OUR NEEDS. IT'S LIGHTER, MORE WORKABLE AND EASIER TO SAW, TAP, MILL OR WELD. IT'S STABLE AND HAS A BETTER SURFACE FINISH. IN SHORT PIONEER 921-T IS SO SATISFACTORY I CAN REALLY ENJOY THIS A.S.T.E. MEETING.
A. S. T. E. SILVER ANNIVERSARY CONVENTION SHAMROCK HOTEL HOUSTON, TEX. MARCH 25 - 27
SHAMROCK HILTON

Pioneer 921-T is available through these suppliers:

ALBUQUERQUE, N.M.: Morris Steel & Supply Co.
ATLANTA, GA.: Southern States Iron Roofing Co.
BOSTON, MASS.: Joseph T. Ryerson & Son, Inc.
BIRMINGHAM, ALA.: Southern States Iron Roofing Co.
CHICAGO, ILL.: Joseph T. Ryerson & Son, Inc.
CLEVELAND, O.: Kaslo Steel Corperation
DALLAS, TEX.: Vinson Steel & Aluminum Co.
DEARBORN, MICH.: Pioneer Aluminum Inc.
DENVER, COLO.: ABC Metals Corporation
DETROIT, MICH.: Kaslo Steel Corporation
GRAND RAPIDS, MICH.: Kaslo Steel Corporation
HAZEL PARK, MICH.: Meier Brass and Aluminum Co.
HILLSIDE, N.J.: Mapes & Sprawl Steel Co.
HOUSTON, TEX.: Vinson Steel & Aluminum Co.
JERSEY CITY, N.J.: Joseph T. Ryerson & Son, Inc.
KANSAS CITY, MO.: Industrial Metals, Inc.
LOS ANGELES, CALIF.: Bralco Metals, Inc.
LOUISVILLE, KY.: Southern States Iron Roofing Co.
MEMPHIS, TENN.: Southern States Iron Roofing Co.
MIAMI, FLA.: Southern States Iron Roofing Co.
MILWAUKEE, WIS.: Joseph T. Ryerson & Son, Inc.
NASHVILLE, TENN.: Southern States Iron Roofing Co
OAKLAND, CALIF.: Earle M. Jorgenson Co.
RALEIGH, N.C.: Southern States Iron Roofing Co.
RICHMOND, VA.: Southern States Iron Roofing Co.
ST. LOUIS, MO.: Industrial Metals, Inc.
SOUTH BEND, IND.: Kaslo Steel Corporation
UNION, N.J.: Mapes & Sprawl Steel Co.
WALLINGFORD, CONN.: Joseph T. Ryerson & Son, Inc
WICHITA, KAN.: Industrial Metals, Inc.

SALES REPRESENTATIVES:
Morris P. Kirk & Son, Inc.
4050 Horton St., Emeryville 8, Calif.
Also: Fresno, Calif.; Phoenix, Ariz.

The Norwest Company
330 Second Ave. West, Seattle 99, Wash.

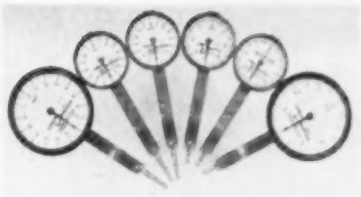
EASTERN SALES OFFICE:
Pioneer Aluminum Inc.
Richard G. Evans, Mgr.
23439 Michigan Ave., Dearborn, Mich.

SOUTHWEST REGIONAL SALES MANAGER:
Howard L. Hutchinson, P.O. Box 702, Dallas, Tex.

PIONEER ALUMINUM, INC.
Subsidiary of MORRIS P. KIRK & SON, INC.
5251 West Imperial Highway · ORegon 8-7621 · Los Angeles 45, Calif.

TOOLING PLATE
HEATING PLATENS
VACUUM CHUCKS
EXTRUSIONS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-210



graduated in 0.0001, 0.0005 or 0.001 in., with a range of 0.008 or 0.016 in.

An all-purpose Check Master model provides both a 0.0001 or a 0.001 indicator, in a single instrument, simply by changing the contact point.

Standard Gage Co., Inc., Poughkeepsie, N. Y. **T-3-2111**

Jig and Fixture Components

These toggle shoe clamps are designed so that the toggle shoe is held in place with a retaining spring that allows the shoe to adjust itself 10 deg in any direction. Constructed for fast easy assembly, they are small enough to cause no interference with the work.

Three types are available from stock: a knurled-shaft type with a hexagon

socket, a knurled-head type with hexagon socket, and a hand-knob type with hexagon socket. All types can be used with their large or small diameter shoe with adjustable V-pads. Each type is available in ¼-20, 5/16-18, ⅜-16, ½-13 or ⅝-11 thread sizes and in lengths from 1 to 5¼ in.

Northwestern Tool & Engineering Co., 122 Hollier Ave., Dayton 3, Ohio. **T-3-2112**

Honing Unit

Bores square with flat end faces are generated on the Model 738 Microhoner to provide accurate locating surfaces for subsequent operations.

A large-capacity loader and a gravity chute carry parts to prefeed position. A plunger moves the part onto the fixture table. The unit also has automatic feeding and aligning of parts, automatic sizing, automatic after-gaging of the finished part by an air gage, and auto-

EMERSON ELECTRIC

AIRCRAFT DIVISION

NEEDS TOOL DESIGNERS!

Are you attending the Tool Engineers' Convention in Houston, March 23-28? Mr. Floyd Reeves, our Employment Manager, and Mr. Taylor Tucker, our Chief Tool Designer, will interview in Houston, Sunday through Wednesday, March 24-27. While there, be sure to call them for appointment at MAdison 3-9211.

EXCEPTIONAL OPPORTUNITIES, RAPID ADVANCEMENT, FASCINATING WORK ON ADVANCED PROJECTS . . . B-58 HUSTLER, F-101 VOODOO AND MANY OTHERS!

- Earnings range from $500 to $900 per month.
- Liberal group insurance and retirement plans.
- Full scale long-range expansion program.
- Excellent air conditioned facilities.
- Big company benefits, small company individuality.
- Fully paid transportation and moving expenses to St. Louis.

Emerson's Aircraft Division projects include the B-58 fire control system, F-101 Voodoo structures, mortar tracking devices, missiles and rockets, other electronic fire control systems and supersonic airframe structures, radar assemblies and aircraft components.

Emerson Electric is a medium size company (5000 employees, 850 engineers) and a national leader since 1940 in design, development and manufacture of electronic and avionic products. Our Commercial Division, established 1890, produces a complete line of fans, motors, air conditioners, heaters, welders and power tools. This perfect balance of aircraft, electronic and consumer production assures stability and security in your career at Emerson.

We're ideally located in beautiful, suburban St. Louis, noted for its unusual friendliness. Our people enjoy relaxed town and country living, with easy access to metropolitan stores, entertainment, cultural, medical and educational facilities. Driving time to work is 5 to a maximum of 30 minutes, unhampered by traffic congestion. St. Louis combines the four seasons into a delightful 'national climate' with low averages of 30.6° in Jan. and high of 79.3° in Aug. Only one day reached 100° in 1956.

YOUR FUTURE IS OUR BUSINESS!

Write us, if you are not planning to be in Houston at the ASTE Convention, and include a brief resume of your education, business background and approximate salary requirements. Send to R. L. Middleton, Employment Manager.

AIRCRAFT DIVISION

EMERSON ELECTRIC

8100 W. FLORISSANT ST. LOUIS 21, MO.

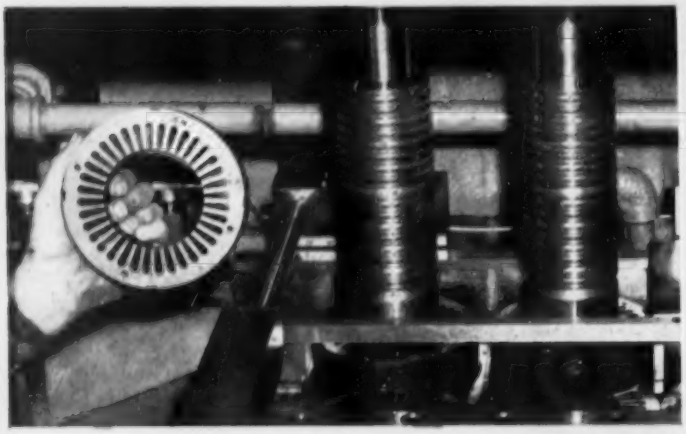
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-211

This situation called for a

SHELL BROACH

. . . another one of those good

LAPOINTE - BROACHES



Large round holes in laminated stator cores were to be broached. Because Lapointe engineers knew about the excess wear-factor that requires consideration when cutting laminated material, it was decided that a shell type broach would be the most practical.

As a result of using this design, a stack of stator cores 2½-inches high can be broached in one pass, with maximum efficiency and economy.

Lapointe designs and builds every type of surface and internal broach, ranging all the way from the simple keyway broach to broaches with extremely complicated forms and minimum tolerances. You should take advantage of the engineering, hardening and grinding "know-how" that goes into Lapointe-built Broaches.

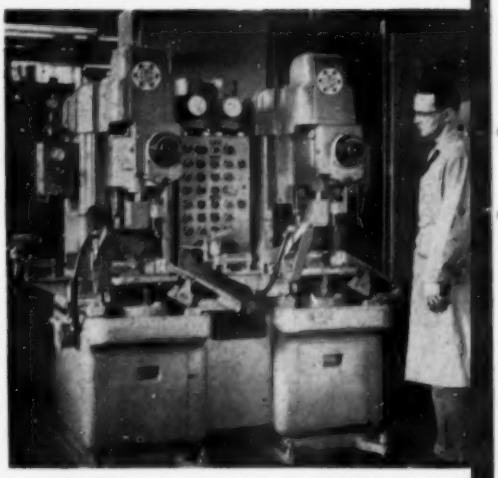
Good broaches cost you less in the long run!

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

Write for BOOKLET No. 1
"How to care for BROACHING TOOLS"

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE
known to be the best in
BROACHING



matic segregation of parts, controlled by the air gage. Sizing, through Microsize control, ends the honing cycle when the bore is to required diameter.

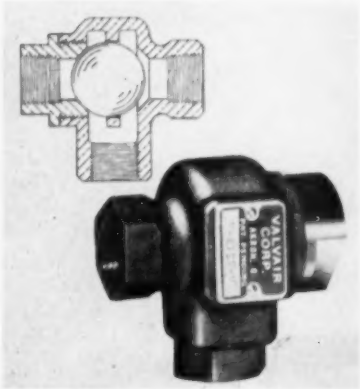
An automatic stonewear indicator, electrically interlocked with the machine controls, visually indicates the amount of usable abrasive in the tool. The machine is automatically shut down when the abrasive is completely worn down or if a predetermined number of parts are not with tolerances.

Micromatic Hone Corp., 8100 Schoolcraft, Detroit 38, Mich. **T-3-2121**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Directional Valve

Immediate switch-over from automatic to manual control of diaphragm-operated valves, cylinders and similar



devices is provided by this directional valve.

Installed as a tee in the inlet lines, it permits manual take-over from automatic control, or control from two different sources. It also can be used to

prevent intermixing of supply when two gases or liquids are being delivered alternately to a tank or container. Automatic in operation, the directional valve can be substituted for a dual top valve.

Suitable for use with air, oil, water or media compatible with Hycar and bronze, the directional valve is available with ¼ and ⅜ NPT ports. Net open area between seat and ball is equal to transverse area of ⅜-in.. standard pipe.

Valvair Corp., 454 Morgan Ave.. Akron 11, Ohio. **T-3-2131**

Stereo Microscope

Up to 3-in. working distance is provided by this stereo microscope which gives an erect, sharp image, correct as to right and left. Viewer sees a wide, three-dimensional field with excellent depth perception. Two sets of objectives are available on a rotating turret. Standard pair of wide field 8X Kellner

eye-pieces gives 21 power and 34 power. Additional eyepieces are available for greater or lesser magnification. The prism erecting system is low reflection coated. The microscope is designed with helical rack and pinion focusing with a control knob for fine adjustment. Interpupillary distance is adjustable.

Edmund Scientific Co., Barrington 17, N. J. **T-3-2132**

Oil Hole Drills

Holes drilled through the body and shank of these high-speed drills permit lubricant or air to pass freely to the drill point to act as a coolant, as well as a force to eject chips and dirt. If blocked by foreign matter in the coolant, the oil holes may be easily cleared and cleaned.

The drills, designed for use on production runs in screw machines or turret lathes, are regularly stocked in straight shank taper length sizes from

7/16 to 1½ in. by 64th. Shank ends are tapped for use with threaded pipe connections or can be made to fit special requirements. Taper shank, extra length and larger diameter oil hole drills also can be furnished.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. **T-3-2133**

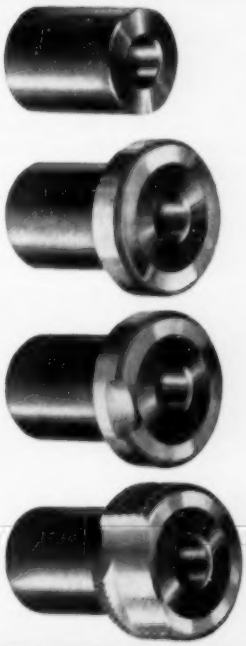
Gage Points

Boron carbide gage points for standard and special gages offer low cost plus unusually long life. In the illustration, a boron carbide (Norbide) indicator point is being used on a Brown & Sharpe #951 electronic comparator. Extremely resistant to wear,

S&E solid carbide drill bushings

A.S.A. Standard
fully interchangeable with Standard Steel Bushings

S & E bushings are precision ground and lapped to exacting finish and tolerance, yielding the highest bushing performance with long life, (more than 50 times the life of steel bushings). This in turn cuts down-time to a minimum, increases tool wear life and provides the users with the highest quality bushing at the lowest production cost.



Ask for illustrated bulletin No. 102

S&E MACHINE PRODUCTS INC.
Plant and General Offices: Bridgeport, Michigan
Sales Offices in all Principal Cities

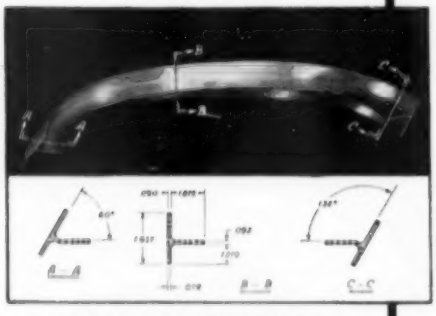
ASTE DATA SHEETS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-213

BATH Contract Forming...

The Contract Forming Division specializes in forming metal to curved shapes. Bath Radial Draw Form methods and stretch form methods are especially suited to producing accurate curved parts from extrusion, strip, sheet and pre-formed sections. A full range of equipment for auxiliary operations is available in the Forming Division.

Bath methods yield accurate parts in the toughest metals... jet engine rings, aircraft and missile shapes, and parts for many other industries.



The Contract Division's facilities are available for production of parts in lots of 100 to 100,000. Send your inquiries to our Estimating Department or write for literature describing in detail the Bath forming methods and the contract facilities available.

THE CYRIL BATH COMPANY

32382 **AURORA ROAD • SOLON, OHIO**
(LOCATED IN THE GREATER CLEVELAND AREA)
Manufacturers of Radial Draw Formers • Dies • Tools
Press Brakes • Tangent Bending Sequence Presses • Press Type Brakes • Special Machines

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-214

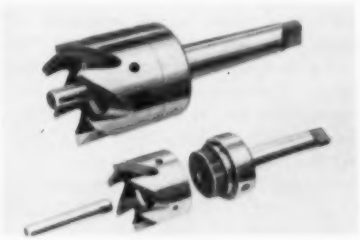
these points will remain clean throughout their entire useful life. They will not pick up dust or become charged. They remain smooth and polished during use and will not scratch work.

Robert Marks Co., 47 Goddard St., Providence, R. I. **T-3-2141**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hole-Cutting Tool

The Hole-Mill, which operates like a conventional hole saw, produces deep holes in flat, thick plate, or on curved cylindrical pieces. In some tool sizes, it is capable of milling through-holes in stock as thick as $\frac{3}{4}$ in. It can be used with automatic feeds on various machines, goes through stock in one pass without clearing chips, and cuts



alloy steels as well as low carbon steels. It can be re-sharpened as required.

Because of the shape of teeth and special chamfer on their sides, chips are forced up and outward. The deep tooth-form leaves ample opening on sides to eject chips even when teeth are buried deeply in the workpiece. Number of teeth is selected on various Hole-Mill sizes to insure maximum tooth strength and can be modified for specific material applications.

The cutter is replaceable and threads onto a separate arbor, which is equip-

ped with a removable, pin type pilot. Step pilots or stub drills can also be used. Each arbor accommodates several mill sizes and is available in all standard tapers and straight shanks.

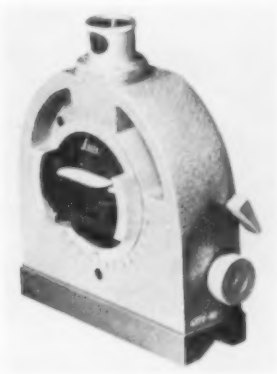
The tools are available in hole sizes from 1 to 4 in. They can be used in all common machine tools and, since they are piloted, can be used on portable equipment.

Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif. **T-3-2151**

Clinometer

Light-weight precision clinometer, manufactured by Leitz, is used for checking the inclination of machine elements relative to a level plane or to each other, and also to assist in obtaining surface flatness during machining operations.

The body is an aluminum casting and the base is permanently magnetized to provide self-clamping in inclined positions. Leveling is possible in both planes. Separate longitudinal and cross



levels are provided for leveling in either plane, with individual fine-adjustment screw for the longitudinal level. The optical circle has a graduation of 120-0-120 deg. A superimposed double vernier in the microscope is direct-reading in degree, minute and 30 second increments. Accuracy of optical circle and sensitivity of level are stated as 15 seconds of arc.

Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y. **T-3-2152**

Furnace Viewer

This remote furnace viewer provides protection for operating personnel during ingot production of titanium and other metals in arc furnaces. The optical viewer permits safe, maximum observation of electrode travel. It fits over the viewing port of the furnace so that the operator can stand outside

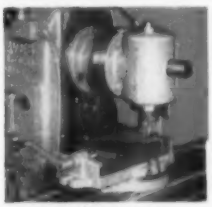
a concrete barrier and study the image of the electrode on an 8 in. ground-glass screen through safety-glass window. The electrode can be visually followed from about 1 to 10 ft. Image sizes varies from about 1.5 in. at a 2-ft working distance to approximately 6 in. at 4 or 5 ft, since magnification of the image changes with respect to the image and object.

Special Products Group, American Optical Co., Instrument Div., Buffalo 15, N. Y. **T-3-2153**

Electrochemical Machine Tool

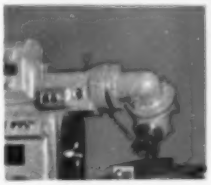
Built as a single unit, this electrochemical machine tool H-1 is designed for forming chip breakers and shaping and finishing tungsten carbide tools. It has a chip breaker side and an off-hand side. A built-in power source furnishes the required direct current.

The unit operates on the basis of electrolysis between a rotating cathode and the tool to be sharpened, serving as an anode, which is brought close to


Heavy Duty Vertical Milling Attachment

Heavy Duty Offset Vertical Milling Attachment

Universal Milling Attachment

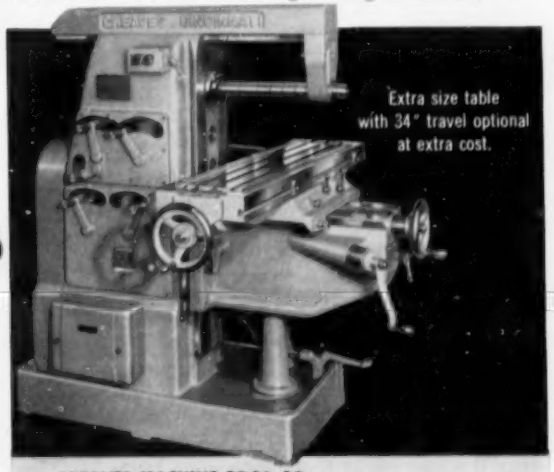

Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS. Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.



Send coupon for FREE Comparison Chart and detailed descriptive literature on easy-to-use attachments.

GREAVES MACHINE TOOL CO.
2303 Eastern Avenue, Cincinnati 2, Ohio

— Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.
— Send information on Attachments and Accessories for GREAVES MILLS.

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-215

Solving problems with VULCAN Tool Steels:

Production run tripled

Until recently, a run of 200,000 switch boxes on a double-acting draw press was an accepted standard at Steel City Electric Company, Pittsburgh. The compound die used in this single-stroke blanking and drawing application is subjected to severe abrasion. The boxes come off the press hot.

Under pressure for greater production, Vulcan Alidie tool steel was used for the complete tooling set-up. 688,000 boxes were produced in one tool run. Inspection proved that the run could have gone even longer.

Is there room for this kind of improvement in your production schedule? Talk to your Vulcan representative—your specialist in *forged* tool steels. *Vulcan Crucible Steel Division, H. K. Porter Company, Inc. Aliquippa, Pa. Offices and warehouses in principal cities.*

Jesse Casasanta, tool and die supervisor, Steel City Electric Company, calls the performance of Vulcan Alidie Tool Steel in this test "a near miracle."

HKP VULCAN CRUCIBLE STEEL DIVISION
H. K. PORTER COMPANY, INC.

FOR FURTHER INFORMATION USE READER SERVICE CARD: INDICATE A-3-216

the cathode. A centrifugal pump supplies the electrolyte to the cathodes which are located at each end of the steel precision spindle. A cup wheel cathode takes care of removal and finishing steps on the offhand side. A peripheral wheel cathode is provided for forming chip breakers.

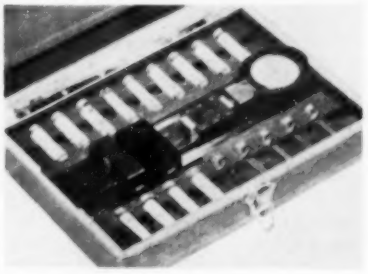
For efficient chip breaker shaping of carbides, one pass of the wheel over the tool can cut a chip breaker ¼ in. wide to any required depth in a matter of seconds. There is practically no diamond wheel wear because the diamonds act as wipers rather than as cutting edges.

Vital components exposed to electrolyte are made of corrosion resistant steel.

Everite Machine Products Co., 2005 E. Huntingdon St., Philadelphia 25, Pa. **T-3-2161**

Roll Dimension Gage

The Roll-Chek provides a fast positive method of checking difficult-to-gage roll dimensions. On countersink type flush-pin gages, roll dimensions may be checked in less than three minutes.

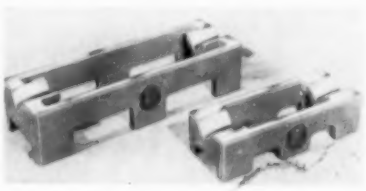


Davis Roll-Chek is also applicable for toolroom use in checking grinding roll dimensions fast and accurately.

Dept. F-11, A. G. Davis Gage & Engineering Co., 21435 Dequindre, Hazel Park, Mich. **T-3-2162**

Parallel V-Block Fixture

Work on drill presses, benches, surface plates, can be supported on these Imp mules. Because the center is open to accommodate punch shanks, the tools are particularly useful to the diemaker when mounting punch plates to punch holders for drilling. V's at each



end are accurately machined in line, and can easily be adapted as a drill jig for rounds.

They are available in two sizes: No. 2, which is 3¼ in. wide, 9 in. long and 2¼ in. high, and No. 3, which is 4½ in. wide, 12½ in. long and 3 in. high.

Illinois Metal Products, 429 W. Superior St., Chicago, Ill. **T-3-2171**

Portable Generator

Two 1500-watt models of this portable electric generator feature vertical shaft design. In these units, the entire weight of the generator is supported by a tubular framework. As a result of this design, the engine main bearing and shaft have longer life and more efficient service.

Simple shock mounting isolates the rotating armature action and engine

vibration from the frame. The entire assembly floats in the framework which serves also as protective guard and carrying handle.

Powered by gasoline engines, the two Thor models—EG-1.5A for ac, and EG-1.5D for dc—provide 13 amp of 155 v current.

Thor Power Tool Co., 175 N. State, Chicago, Ill. **T-3-2172**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Master Vernier Caliper

Long 50-division Vernier scales with widely spaced, easy-to-read graduations are featured on the No. 123 satin chrome master vernier caliper, to simplify setting and reading without use of a magnifying glass. This feature permits having half the conventional number of graduations on the bar.

Both vernier plates fit flush with the main scale, thus avoiding reading errors due to parallax. Both the inside and outside vernier scales are located on the same side of the tool so the caliper

is held and read identically for inside and outside measurements. The master bar and both vernier scales are machine-divided to precise standards.

The gage is available in 12 and 24-in. sizes graduated in thousandths to read the full 12 or 24 in. length.

The L. S. Starrett Co., Athol, Mass. **T-3-2173**

Hand Notcher

Notches from 90 deg up to 1 in. deep in all thicknesses of metal up to and including 16-ga mild steel or its equivalent can be cut with the No. 241 hand metal notcher. The blade is designed with a slightly hooked shape to provide shearing action and easy cutting, but also so that the tip may be engaged on a punch prick for accurate location of the notch.

The tool weighs only 7 lb and is 21 in. long. Notching die is fixed to the end of one handle while the blade is

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-217

Each page will give you new cost-saving ideas

We'll be glad to send you a copy of this new catalog– *Write Today*

BUCK TOOL COMPANY

333 Schippers Lane
Kalamazoo, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-218-1

DEKA® BORE

OFFSET BORING HEAD

repeats to

.0001"

in 30 seconds

DEKA-BORE (and only DEKA-BORE) can be adjusted in fractions of 1/10,000" on the full diameter as easily as reading 1/16" on a steel rule. NOT A VERNIER OR SCROLL ADJUSTMENT. Can be calibrated in increments of .00005 on radii or .0001 on diameter as easily as picking up .002 on a conventional micrometer dial.

100% GUARANTEED!

mail coupon now for free demonstration or literature!

PRECISION TOOL & MFG. CO. OF ILL.
1305 South Laramie Cicero 50, Illinois TE-3

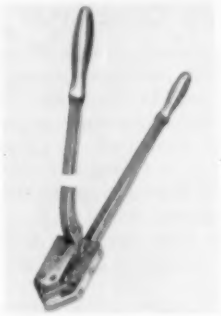
Gentlemen: Please send me
☐ Name of nearest DEKA-BORE distributor, who will arrange free demonstration.
☐ Free literature and prices.

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE ___ STATE ___

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-218-2

operated by a double lever or linkage action that greatly multiplies the force exerted on the handles. Both blade and die are easily replacable.

Either square or angled notches can be made in corners of sheet, up to length of 1½ in. on a side. Corners can be sheared off at any angle with a maximum length of cut of 1½ in. The tool also will notch flanges and folded-



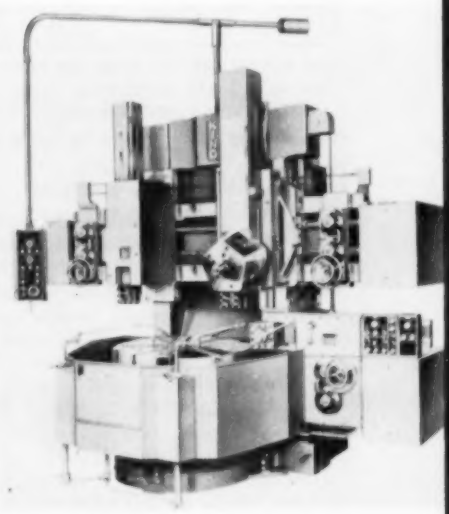
up edges, even in narrow channels. The blade holder is shaped to provide instant registering of the cut in one flange with a corresponding cut in the other flange where the flanges are 1 in. or less apart.

Whitney Metal Tool Co., Rockford, Ill. **T-3-2181**

Vertical Boring and Turning Units

Fully electrical in their operation, these vertical boring and turning machines offer 24 feeds from 0.0016 to 0.250 in. per table revolution, and 24 speeds in any one of three standard ranges: low, intermediate or high. All controls are located on the movable pendant station and on an auxiliary control panel mounted on the machine.

Horsepower ranges from 40 to 50 on



30, 36 and 46-in. sizes, and 75 to 100 on sizes 56 in. and up.

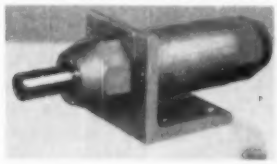
Spindle and spindle mounting are designed to provide maximum table stability with resultant high machining accuracy. Unit construction of spindle drive provides simplified maintenance. Other features are antibacklash nuts for all cross-feed movements and automatic lubrication of all moving parts.

The machine illustrated is a 46-in. size with ram and turret head on rail. It is equipped with a side head, and coolant pan. Others are available in 30, 36, 46, 56-in. sizes and up, in a variety of head combinations, with or without side head.

American Steel Foundries, King Machine Tool Div., 1150-Z Tennessee Ave., Cincinnati 29, Ohio. **T-3-2191**

Impact Tool

Designed for mounting at any angle, this impact tool attachment can be used on drill presses, special machines, arbor presses and other machines. Designed for mounting at any angle, Impact-Tool



greatly simplifies marking, light piercing staking and riveting.

The tool operates on line pressures as low as 20 lb and can be actuated electrically by solenoid or manually by poppet valve. There is only one moving part.

Air-Impac Co., 920 Walnut, Flint 1, Mich. **T-3-2192**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Automatic Sizing Gage

Pneumatic indicating device is applicable to any grinding gage with standard fitting for dial gages. Measuring heads are available with and without zero adjustment.

The gage, called Deltameter, is suitable for machine control when gaging is done during processing of parts, selective sorting or other control methods in which it is desirable to actuate electric circuits for control purposes.

Deltameter gages are available with symmetric scales and graduated in 0.001, 0.0005, 0.0001 and 0.00005 in. Indicating Deltameters for grinding operations have a scale range of 0.013

here is

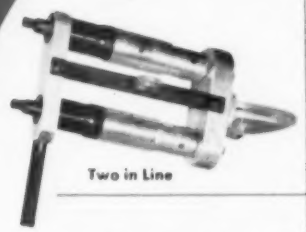
Creative Tooling

CLECO

AIR-OPERATED

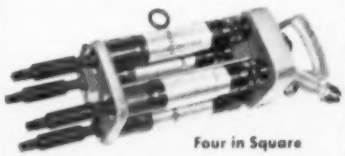
MULTIPLE-SPINDLE NUTSETTERS

TYPICAL UNITS

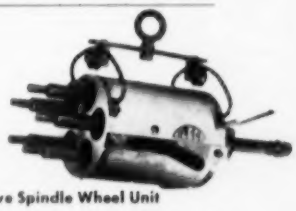


Two in Line

Three in Triangle



Four in Square



Five Spindle Wheel Unit

24-Spindle Oil Pan Unit

For increased production and lower overall cost, make Cleco a working part of your creative tooling program. In fact, *wherever* your operation involves air-power for production equipment, whether Portable, Semi-Automatic or Automatic, think first of Cleco.

WRITE FOR LITERATURE AND COMPLETE INFORMATION

CLECO AIR TOOLS

- Grinders • Sanders • Rotary Drills
- Riveters • Backfill Tampers • Chippers
- Scaling Tools • Nut Runners
- Impact Wrenches • Multiple Spindle Units
- Screwdrivers • Sump Pumps
- Paving Breakers • Spike Drivers
- Air Line Accessories and Fittings

Division of the REED ROLLER BIT COMPANY

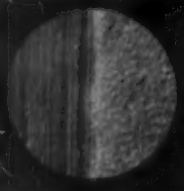
5125 CLINTON DRIVE • HOUSTON 20, TEXAS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-219

SMOOTH
but plenty tough!

WENDT-SONIS tools cut fast and clean . . . stay sharp

The difference is in the finish!
All Wendt-Sonis drills, reamers, counterbores and other round tools are 30% smoother by profilometer readings. Flo-Finish, an extra operation applied after final grinding, practically eliminates grinding marks.



30% smoother Flo-Finish reduces chip friction — permits faster chip flow away from cutting edges — faster feeds and speeds. Lower chip friction also means less tool-damaging heat with a resulting increase in tool life. In addition, less power is required, and work finish is improved — in some cases by an average of 50%.

Micro-photograph (right side) shows how Flo-Finish eliminates grinding marks.

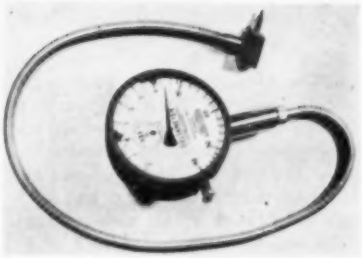
For detailed information on Wendt-Sonis tools, for competent technical assistance on tooling problems, see your Wendt-Sonis distributor's salesman.

Send for free 94-page Catalog No. 55—Address Dept. TE-357

WENDT-SONIS COMPANY

Hannibal, Missouri • Rogers, Arkansas

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-220



in. divided in one coarse and one fine measuring range. Measuring accuracy is within ±0.00005 in.

The dial is about 5 in. in diameter and can be easily read from a distance. Instruments with up to 12 electrical contacts can be furnished.

The C. E. Johansson Gage Co., 10641 Haggerty Ave., Dearborn 1, Mich.

T-3-2201

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tap for Cast Iron

Stronger, free cutting tap, called the Strate-Face, has a flute form which makes it effective in tapping cast iron. It has a straight cutting face with a scientifically-determined rake angle, to

provide accuracy in tapped hole sizes. The flute and core design provides a high strength zone resulting in strong tap, long tap life and low breakage.

These taps are available in standard ground thread sizes from #6 to ¾ in.

Besly-Welles Corp., South Beloit, Ill.

T-3-2202

Scrap Chopper

Scrap stock feeding from the press is taken by this pressroom accessory which uses an orbital shearing action to chop it into a size easily and economically stored for collection.

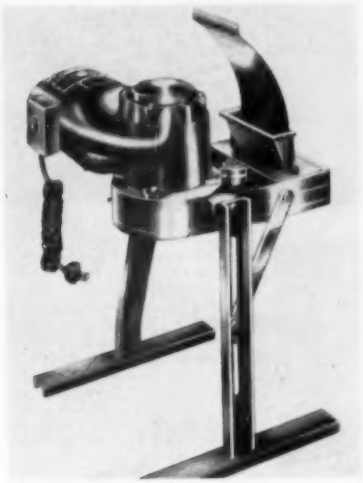
The unit may be tipped at any angle required for feeding. The chute through which material passes to cutting blades has a reciprocating action which prevents the stock from hanging-up.

Cutting blades are ⅜ in. thick, ground on one surface only, are self-aligning and still usable when reground down to half the original thickness.

The cutting action allows equal opening at each end of the cutting blades

to permit free entrance of material through the blades. Thick stock that is accidentally fed between blades, simply stalls the unit without danger of breakage to any parts. The motor is heat-protected.

The scrap-chopper is powered by a



⅓-hp, 115/230-v, single-phase, 60-cycle drive. Present model has a capacity of 6 in. wide by 0.065 mild steel.

Cooper Weymouth, Inc., Stratford, Conn. **T-3-2211**

Band Saw

Designed for cutting mild steel, stainless steel and hardened steel up to ¼

in. thick, this Connecticut band saw features friction cut to produce smooth, accurate edges with a minimum of burr and without distortion.

The saw is available in three models and different speeds for cutting a variety of materials. Model A-24-S offers a single speed anywhere between 1860 and 6000 fpm for wood, plastic, nonferrous metals and friction cutting. Model A-24-3 has three fixed speeds: 150 fpm for sawing heavy mild steel; 640 fpm for stack sawing galvanized sheets; and 4870 fpm for nonferrous metals, wood, plastics and friction cutting.

Model A-24-V has a 3-range variable speed drive: 58-173 fpm for tool steel and heavy mild steel; 244-730 fpm for heavy nonferrous materials and stack-sawing galvanized steel sheets; and 1822-5460 fpm for nonferrous metals, wood, plastics, and friction cutting.

W. Whitney Stueck, Inc., Old Saybrook, Conn. **T-3-2212**

Profiling Unit

High production 360-reg profiling, 3-dimensional contouring and swarf or twist machining can be performed in steel, aluminum or titanium with this machine.

Using a hydraulic tracing valve, the operator manually traces a template, and the cutting tool machines profiles or 3-dimensional contours to an accuracy of ± 0.005 in. For swarf or twist cuts, the spindle is mounted on arc-shaped ways which permit the spindle to pivot 20 deg either side of vertical center line.

A 20-hp hydraulic powered spindle, with speeds from 37 to 3000 rpm gives the unit the necessary range and power

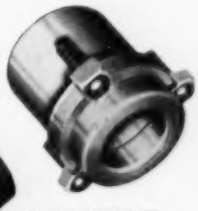
"We saved $40,000 in 8 months with LAMINA GUIDE PINS and BUSHINGS"

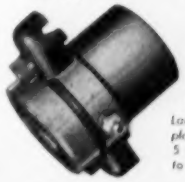
Research and experimentation have proved that guide pins and bushings are almost as important to die performance and upkeep as the design and manufacture of the die itself. Lamina Guide Pins and Bushings, in fact, can effect a substantial savings in production costs as this quotation from an actual user letter attests . . . "On a limited test of Lamina Guide Pins and Bronze-Plated Bushings we have saved approximately $40,000 in die maintenance over a period of eight months."

Precision-produced Lamina Bushings combine hardened steel for strength, bronze plating for free, smooth action to eliminate seizing and scoring. A pre-finished I.D. assures full length roundness and straightness for better fit, finer alignment, longer life. Lamina Guide Pins, made of special, uniformly hardened tool steel, resist wear, bending, "mushrooming". Further, Lamina grinding and burnishing methods insure perfect concentricity and dimensional accuracy. You can be sure, too, whatever your requirements, that Lamina offers a size and type guide pin and bushing for your needs.

STRAIGHT TYPE PIN
¼" to 4½" diameter. Shoulder and removable types also available.

SHORT SHOULDER TYPE
Small toe clamp, bronze-plated or solid Ampco Bronze. 7 lengths, pin diameters ¼" to 2".





HEAVY DUTY TYPE
Large toe clamp, bronze-plated for heavy die sets. 5 lengths, pin diameters 2" to 3".

Special Pins and Bronze-Plated Bushings for any application . . . send prints for prompt quotation.

If you build or use die sets, you'll want a copy of Lamina's new 40 page catalog. Complete with illustrations, applications, dimensions and prices of Lamina Guide Pins, Guide Pin Bushings and accessories, the catalog is yours for the asking. Write today for your free copy.

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

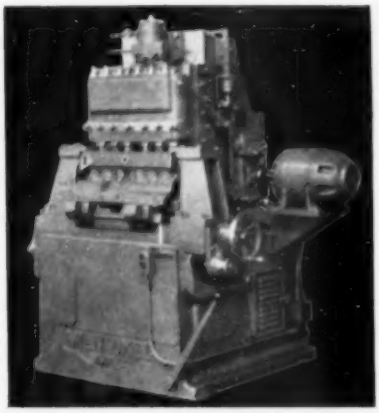
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-221

Milling production 25 years ago

...less than 10 motor blocks per hour

Milling, drilling, chamfering and tapping production TODAY...

103 motor blocks per hour!



Twenty-five years ago tool engineers marveled at this Kearney & Trecker Mill (above.) Today tool engineers rate a salute for their vital roles in the development of outstanding tools like this Kearney & Trecker Special Machinery Division high-production Automatic Transfer Machine (below.)

AMERICAN SOCIETY OF TOOL ENGINEERS
25th ANNIVERSARY
1932 1957
A BETTER LIFE THROUGH CREATIVE MANUFACTURING

KEARNEY & TRECKER
MILWAUKEE

Not only have production rates vastly increased with modern machine tools such as KEARNEY & TRECKER Mills and special Six-Station Automatic Transfer Machines (above) — but multiple machining operations are also performed.

It's engineering progress and leadership like this that illustrates why so many large and small metal-working firms take advantage of Kearney & Trecker's ingenuity and skill in solving their special machining and production problems.

For details contact Special Machinery Division, Kearney & Trecker Corporation, 6772 West National Avenue, Milwaukee 14, Wisconsin.

Special Machinery Division
MILWAUKEE 14, WISCONSIN, U.S.A.

Designers and Builders of Precision and Production Machine Tools Since 1898

ATLANTA, GA.
Scott Machine Tool Co.
411 Williams St., N.W.

BIRMINGHAM, ALA.
George M. Meriwether Industrial Equipment
1712 Seventh Ave. North

BOSTON, MASS.
Stedfast & Roulston, Inc.
11 Deerfield St.

BUFFALO 23, N.Y.
Syracuse Supply Co.
1965 Sheridan Drive

CHARLESTON, W. VA.
Wm. S. Bolden Co., Inc.
MacCorkle Ave.

CHATTANOOGA, TENN.
Scott Machine Tool Co.

CHICAGO, ILL.
Jackson-Fotsch Co.
7350 West Lawrence Ave.

CINCINNATI, O.
The E. A. Kinsey Co.
327-335 W. Fourth St.

NEW YORK, N. Y.
Kearney & Trecker Corp.
409 Grand Ave.
Englewood, New Jersey

NEW ORLEANS, LA.
Stauss & Haas, Inc.
524 Camp St.

OMAHA, NEB.
Fuchs Mach. & Supply Co.
2401 N. Eleventh St.

PHILADELPHIA, PENN.
Machinery Assoc., Inc.
325 E. Lancaster Ave.
Wynnewood, Penna.

PITTSBURGH, PENN.
Kearney & Trecker Corp.
4 West Manilla Ave.

PORTLAND, ORE.
Harry M. Euler Co.
2811 N.E. Gilsan St.

RICHMOND, VA.
Smith-Courtney Co.
Seventh & Bainbridge Sts.

For details, contact these

KEARNEY & TRECKER DISTRIBUTORS

or write to

KEARNEY & TRECKER CORP.
6772 W. National Ave., Milwaukee 14, Wis.

CLEVELAND, O.
Kearney & Trecker Corp.
Euclid Ave. & E. 17th St.

COLUMBUS, O.
The E. A. Kinsey Co.
1020 W. Fifth St.

DALLAS, TEX.
Greene Machinery Co.
6300 Wyche Blvd.

DAYTON, O.
The E.A. Kinsey Co.
16 Washington St.

DENVER, COLO.
F. J. Leonard Co.
1219 California St.

DETROIT, MICH.
Kearney & Trecker Corp.
10600 Puritan Ave.

GREENSBORO, N. C.
Smith-Courtney Co.
239 S. Davie St.

HICKORY, N. C.
Smith-Courtney Co.
103 3rd Street, S.W.

HOUSTON, TEX.
Steel & Machine Tool Sales
6414 Navigation Blvd.

INDIANAPOLIS, IND.
The E. A. Kinsey Co.
1550 Stadium Drive

KANSAS CITY, MO.
Blackman & Nuetzel Machinery Co.
1103 E. Armour Blvd.

LOS ANGELES, CALIF.
Moore Machinery Co.
3200 S. Garfield Ave.

MILWAUKEE, WIS.
Kearney & Trecker Corp.
6784 W. National Ave.

ROCHESTER 4, N. Y.
Syracuse Supply Co.
311 Alexander Street

ST. LOUIS, MO.
Blackman & Nuetzel Machinery Co.
3713 Washington Ave.

ST. PAUL, MINN.
Sales Serv. Mach. Tool Co.
2363 University Ave.

SALT LAKE CITY, UTAH
Todd Machinery Co.
4165 Holloway Drive

SAN FRANCISCO, CAL.
Moore Machinery Co.
7th & Carleton-Berkeley

SAN JOSE, CALIF.
Moore Machinery Co.
656 Stockton Ave.

SEATTLE, WASH.
Dawson Mach. Co.
5700 First Ave., S.

SHREVEPORT, LA.
Peerless Supply Co., Inc.
701 Spring St.

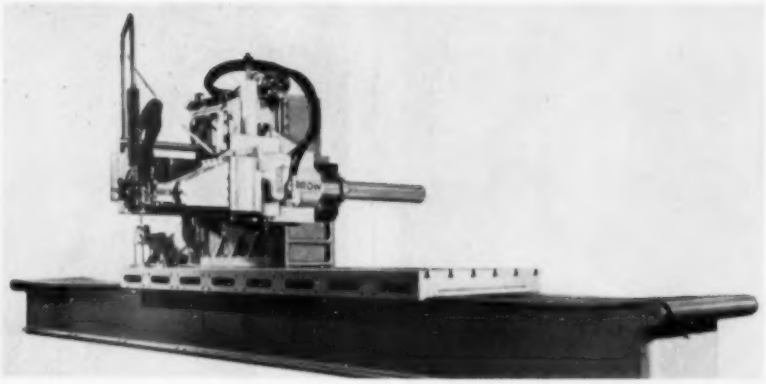
SYRACUSE 1, N. Y.
Syracuse Supply Co.
314-332 W. Fayette St.

TULSA, OKLA.
White Star Mach. Co.
104 Boulder Bldg.
19 West 10th Street

WICHITA, KAN.
White Star Mach. Co.
301 N. St. Francis

CANADA
MONTREAL
OTTAWA
QUEBEC
TORONTO
WINDSOR
Williams & Wilson Ltd.

KEARNEY & TRECKER MILWAUKEE



to machine steel as well as aluminum and titanium. Speed changes are made through pick-off gears, providing up to 30,000 in-lb of torque at 37 rpm.

The Profiler table measures 42 x 144 in. with 136-in. travel. Table feed is 0-40 ipm with rapid traverse of 100 ipm. Six full length T-slots provide clamping facilities for tooling or fixtures.

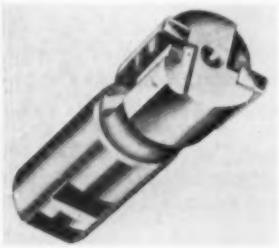
Arrow Engineering Co., Inc., 120 E. Market St., Indianapolis, Ind. **T-3-2231**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Inserted-Blade End Mills

Self-gaging design minimizes grinding time of a series of inserted carbide-tipped blade straight-shank end mills. Another feature of the mills is a quick-change diameter adjustment. Nine different sizes are available, standardized specifically for high-performance milling of aluminum and light metal alloys.

Diameters range from 1 to 2½ in; length of cut is 1½ or 2 in.; shank



lengths range from 2¼ to 3¼ in.; and shank diameters are from 1 to 2 in., to fit standard end mill holders. Right-hand cut is standard.

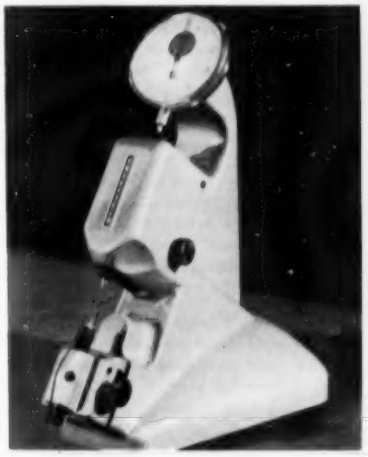
Blades are held in the cutter bodies by replaceable serrated wedges that combine to produce crosslock construction. For quick adjustment, cutter diameters can be increased in 1/32-in. increments. No gages are required to check uniformity of blade projection as this is controlled by the serrations.

Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, Mich. **T-3-2232**

Thread Gage

Pitch diameters of any threaded part having external screw threads up to 1½-in diam and of any specified pitch can be checked and indicated by the Thread Checker gage.

No special wires or attachments are required. The instrument is simple to operate mechanically to obtain pitch diameter readings from 0 in. upward on a dial graduated in 0.0001 in increments. For more precise measurement, the Thread Checker may be adapted for use with Sheffield single-column Precisionaire® air gages and Plunjet® air gaging cartridges or with the electronic Accutron Amplifier and Electrojet pick-up unit.



The device uses one pair of gaging tips for each pitch of thread to be checked. Tips have threaded shanks and are interchangeable to check vir-

Unique Head on Drill Press Speeds Production 2½ Times

Drilling 5/32" holes 3/8" deep, in tough forged rivets is a requirement in the production operations of the Bradley Washfountain Company, Milwaukee, Wisconsin.

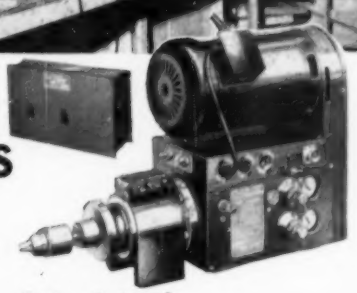
Former methods produced only 125 pieces per hour with very high drill breakage due to the hard stringy metal. How to reduce drill breakage and increase production was an ever present problem with this manufacturer.

New Head Tried

In an attempt to solve it, a special automatic drill unit, with all operating and control mechanisms built-in, was set in place of the standard head on the drill press regularly used for this work. A cycle timer and unloading chute were added to complete the new set-up. Note the special mounting bracket, an accessory supplied by the manufacturer, used to secure the new drill head to the standard drill press column. Because more accurately controlled precision feeds and speeds are possible with this new drill head, these remarkable new production results were achieved:

1—no drill breakage
2—333 pieces per hour—
2½ times former production
3—lower unit cost

This unique drill head is a completely new and different production tool. It is the Dumore Automatic Drill Head, Series 24, designed for single or multiple unit operations where versatility and flexibility are necessary to meet the varying conditions and frequent changeovers of diversified manufacturing. In this case, it proved its worth on one set-up. When desired, it can be moved quickly and easily to numerous other operations with minimum time loss. For further information about this and other automatic precision tools for greater production possibilities at lower cost, write to The Dumore Company, 1310 Seventeenth Street, Racine, Wisconsin.



PRODUCTION RUNS *doubled*

with this New 2-in-1 tool
the DUMORE Series 28 Automatic
"DRILL-N-TAP" UNIT

A large aircraft parts manufacturer uses a bank of 9 "Drill-N-Tap" Units, mounted on standard drill press columns, to get twice as much production per hour at lower cost, over hand methods. This combination set-up handles hundreds of small and large drilling and tapping operations daily. Drill brushings are simply removed when tapping. Tap fits into chuck, no extra head is required. *A flip of the switch controls tapping or drilling.*

This company also uses over 40 Dumore Series 24 Drill Units for all types of production drilling operations. They find that these automatic machines further help to cut costs and speed output all along the line.

A *driller* and a *tapper* . . . all in the same tool . . . at the cost of only one!

It drills or taps without attachments with less tool breakage and scrap losses. No long overhang, or expensive clutches to wear out. Self-reversing motor, electrically controlled, withdraws tap by reversing spindle rotation. Work mounts close to fixture with little tool travel for faster cycling, less idling time.

Mounts in 3 minutes —anywhere — with simple nose mounting bracket, on job after job for production runs in the high thousands or low hundreds. 10 speeds from 265 to 4900 rpm standard.

Available as complete Drilling and Tapping Press with fixture, press and "Drill-N-Tap" Unit, or, "Drill-N-Tap" Unit supplied with bracket to convert your 14" x 17" drill press into a completely automatic drilling and tapping machine.

GET A DEMONSTRATION NOW . . . SEE YOUR DISTRIBUTOR, OR WRITE

YOU CAN DO MORE WITH DUMORE DRILL UNITS
DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • CHAMFERING • DEBURRING

DUMORE
PRECISION TOOLS

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS

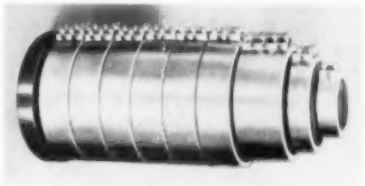
1310 Seventeenth St., Racine, Wis.

tually any pitch of any straight screw thread. Either a 16 or 40-oz gaging pressure may be selected by the operator. Other gaging pressures are available. Setup is made from a master thread plug or a previously calibrated part.

Div. 710, The Sheffield Corp., Dayton 1, Ohio. **T-3-2251**

Heating Bands For Injection Molders

Thermastrip bands for all makes and models of injection molding machines are designed to improve efficiency of the units by more than 40 percent. They provide full-circle heating, positive pressure, rapid assembly even on hot cylinders, minimized contamination of terminals and wiring. The tubular elements are built for long life at 440 volts. There is complete interchangeability of individual component parts, which are adaptable to ¼-in. variation in cylinder diameter.

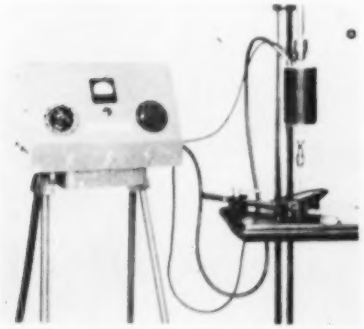


The bands are available in 1½ or 2½-in. widths; diameters 4 to 12 in. are standard although larger diameters are available.

Thermal, Inc., 9400 Robinson Rd., Franklin Park, Ill. **T-3-2252**

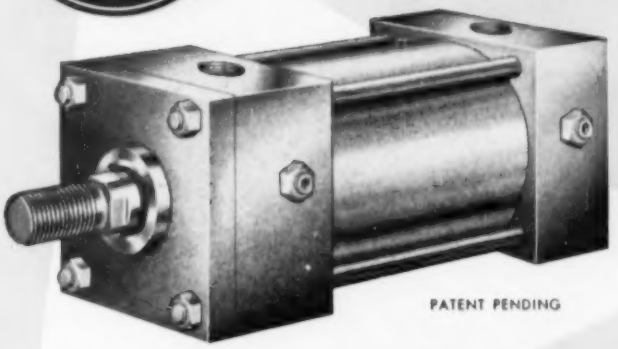
Metal Disintegrator

Hardened steels, carbides, titanium, borium, permanent magnets, cast alloys, cobalt, nickel and other hard metals can be cut easily with this model C-56 disintegrator machine. Designed primarily for removing broken taps, reamers, studs, set screws, ejector pins or bushings, the unit is also used for cutting



FOR AUTOMATION

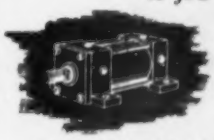
SP CYLINDERS



PATENT PENDING

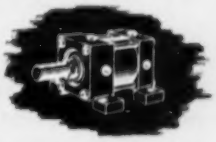
top performance–longest life

All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.



S-P STANDARD AIR CYLINDERS have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" – 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

S-P HEAVY DUTY AIR CYLINDERS for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" – 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.



S-P HIGH PRESSURE HYDRAULIC CYLINDERS have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

SPecify SP

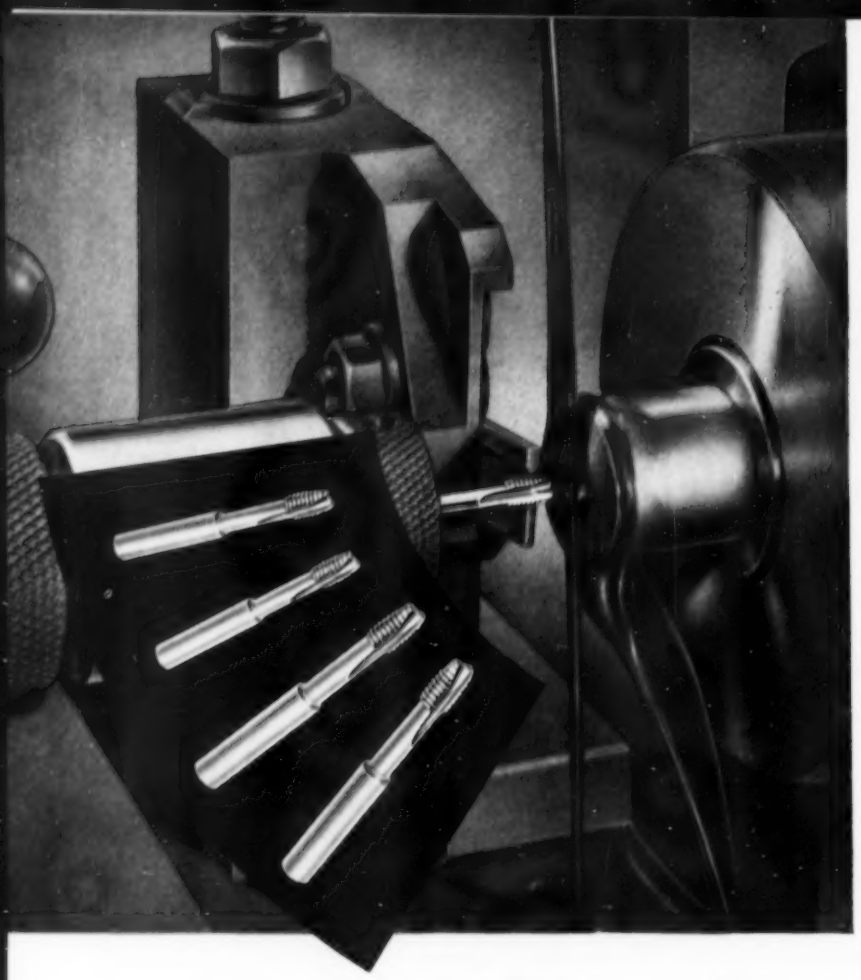
SP THE S-P MANUFACTURING CORP.

SOLON, OHIO • IN GREATER CLEVELAND

ESTABLISHED 1916 A BASSETT COMPANY

NON-ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-225



Here, for the FIRST Time . . .

IS A TAP SPECIFICALLY FOR SCREW MACHINES.

This new high speed steel, ground thread tap with its short thread length, spiral point, and specially heat-treated necked shank cuts cleaner threads, has longer life, reduces bellmouth condition and tap breakage . . . and pays big dividends in improved work quality, increased output, and lower tooling costs! Tests prove that performance is excellent on practically all machinable metals. Plug and bottoming types in machine screw sizes No. 2 to No. 10 . . . available *now* from stock at the P&W Branch Office near you. Write for complete information. *Pratt & Whitney Company, Inc., 16 Charter Oak Boulevard, West Hartford, Connecticut.*

. . . THREAD ROLLING DIES • DUOCONE DIES • TAPS • THREAD MILLING CUTTERS • REAMERS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

dovetails in hardened dies and tools, new centering holes in taps, internal and external keyways and slots, oil holes, pilot holes through taps or reamers.

As shown, this unit may be hooked up to any drill press.

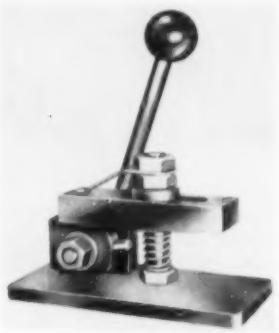
The Cammann Mfg. Co., Inc., 2700 Henninger Rd., Cleveland 9, Ohio

T-3-2261

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Clamp Assembly

In the simplified design of this cam lever clamp, a hexagon shaft connects the handle to a cam. Continuing rise in the cam causes the clamping action.



Three tapped holes in a fixture base are required to mount the unit.

Handle on the assembly is adjustable throughout 360 deg. It can be used on either the right or left side of the clamp.

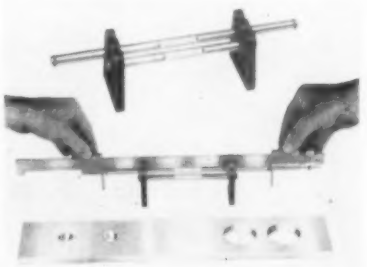
Monroe Engineering Products, Inc., 1515 Hurd Rd., Monroe, Mich.

T-3-2262

Hole Location Gage Accessory

The Booster-Bar is used with Center-Mike hole-location gages to measure greater center-distances.

There is a Booster-Bar for each of the three standard Center-Mike sizes; the largest adds 9 in. to the measuring



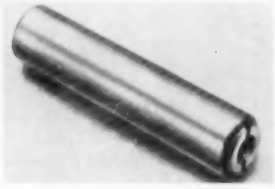
range of the A12 gage raising it from 12.4 inches to 21.4 inches.

Each accessory assembly has a long and a short precise-length rod which are held in plastic brackets that are slotted to hold the Center-Mike in the second step of the measuring sequence. The two rods give coverage for all combinations of hole diameters and center-spacing, from the normal range-limit of the gage alone to the extended range limit supplied by the bar.

Sorensen Center-Mikes, Inc., 264 Kossuth St., Bridgeport 8, Conn. **T-3-2271**

Pneumatic Cylinder

This single-acting cylinder has only two moving parts and can be adapted to a variety of applications for lifting, ejecting, clamping, back gaging, and similar uses. It is useful both as a kicker in pressroom installations and as a disappearing back gage pin facilitating loading and unloading of stampings. It measures 3½ in. plus stroke in length, and 1¼ in. in diameter, and



can be actuated by a 30-psi air line. Strokes most frequently used are the 2½, 4½ and 6 in.

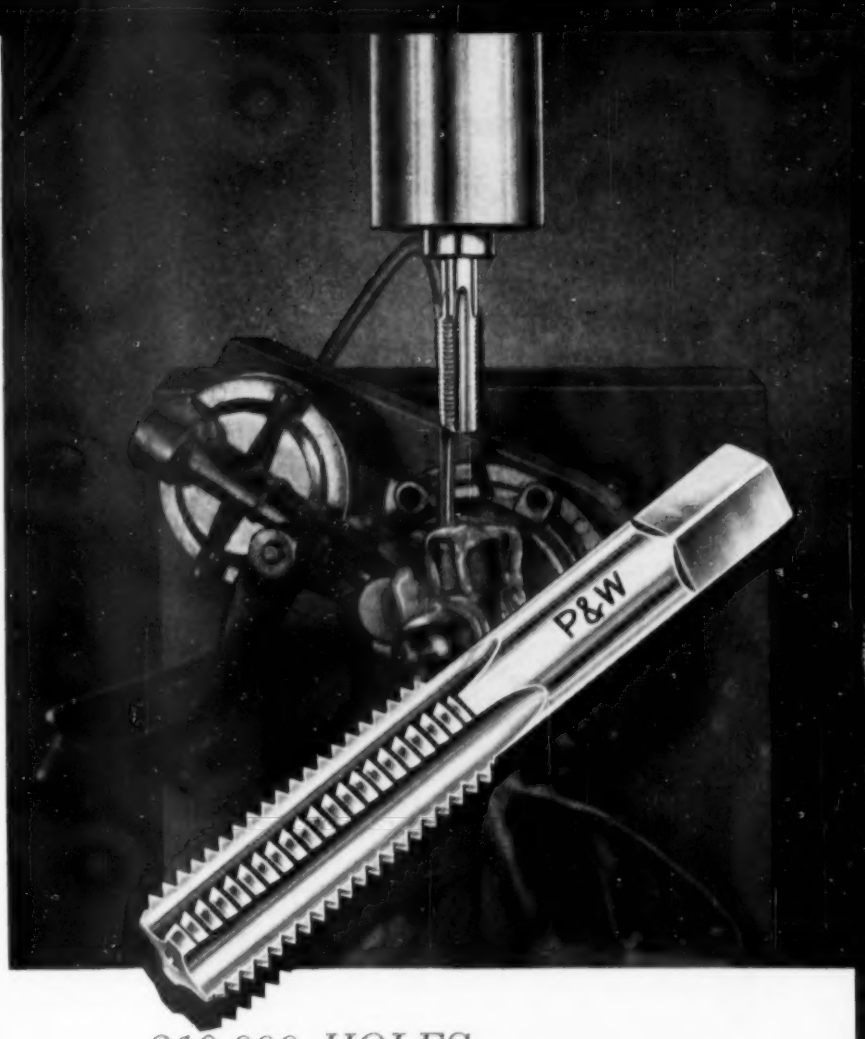
A thin-walled piston rod in the kicker prevents damage to die sections in the event of air-line failure. Total collapsed thickness of the piston rod is comparable to the gage of metal being formed or fabricated in the dies.

Sahlin Engineering Co., Inc., P. O. Box 289, Birmingham, Mich. **T-3-2272**

Milling Arbor

This milling arbor design provides alignment accuracy and fast setup. Both the large end bearing surface and the grooved-end-collar are decidedly larger in diameter than the spacers used on the arbor. There is no need for cocking when the spacers and sleeves are snubbed up on the arbor.

The grooved outside diameter and large size of the end collar make it



210,000 HOLES . . .

AND STILL RUNNING!

120,000 pieces before the first grind . . . 90,000 after grinding . . . and still producing accurately threaded holes! These are the actual performance figures reported by a satisfied user of P&W Taps. Performance like this is possible, because P&W Taps are *always* accurate, always concentric with shanks, threads, OD's and chamfers . . . *all* ground *on centers.*

When you buy taps, *you're really buying the number of finished workpieces they'll produce.* That's why Pratt & Whitney Taps and other Cutting Tools are your best buy. Complete lines available from stock at the P&W Branch Office near you. Write for full information. *Pratt & Whitney Company, Inc., 16 Charter Oak Boulevard, West Hartford, Connecticut.*

. . . MILLING CUTTERS • CUT-OFF BLADES • END MILLS • KELLER CUTTERS • KELLERFLEX BURS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS . GAGES . CUTTING TOOLS

GUARANTEED ACCURACY has developed from more than 90 years' specialization with practical metrology. The resulting SIP techniques—as used in length measurements by national Bureaus of Standards—may be most profitably applied with SIP UNIVERSAL & LINEAR MEASURING MACHINES, SIP high precision MICRO-INDICATORS, and SIP PROFILE PROJECTORS. How well these techniques and machines can work to your advantage is illustrated in the film offered below.

FREE Showing 16mm. Sound Film

"ABSOLUTE MEASUREMENTS"

AMERICAN SIP CORPORATION
100 East 42 Street, New York 17, N. Y.

Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Absolute Measurements."

NAME

FIRM

ADDRESS

CITY

STATE

INDICATE A-3-228-1

quickly identifiable by touch or eye.

A large fillet reinforces the stress point between the arbor and shank on the arbors, and guards against breakage under heavy loads.

These features are available on two styles of arbors. Style A, used for light work and small cutters, is made in standard sizes from $\frac{7}{8}$ to $1\frac{3}{4}$ in. For larger cutters and dual overarm support, Style B is made in standard sizes from $\frac{7}{8}$ to $2\frac{1}{2}$ in.

Scully-Jones and Co., Chicago, Ill
T-3-2281

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Self-Locking Set Screw

Locking action of this self-locking set screw called the Crest-Lok, is provided by an unthreaded portion, a thread and a half high, of the set screw. Diameter is approximately the pitch diameter size and tends to compress the crest of the threads in the tapped hole when driven to a flush position.

There is need for precise hole tapping. Amount of locking action can be controlled simply by changing the tap drill diameter. Repeated reuse does not appreciably affect locking action.

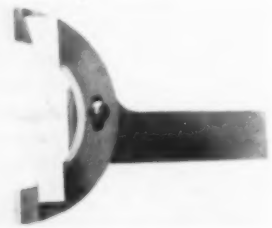
They can be hopper-fed through the Setko System for hopper feeding headless set screws in sizes as small as #2 (0.086 in.).

Any size headless set screw, socket, fluted, slabbed and slotted, in Setko Nu-Cup and all other standard or special points are available.

Set Screw & Mfg. Co., Bartlett, Ill.
T-3-2282

Cutoff Tool

Great savings in cutting time, blade replacement costs and power are achieved with the new Speedway cut-



off tool assembly for lathes and automatic machines. It is so constructed that there is no overhang problem; the cutting edge is supported by tension instead of bending moment. This design permits use of a thin blade in relation to depth of cut. For example, for

NOBLE & STANTON

Standard

JIG & FIXTURE COMPONENTS

complete line—over 500 parts

"FIXTURES IN A JIFFY"

"T" ANGLE PLATES

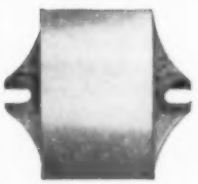
Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized, precision-machined castings—7 standard sizes.

BOX JIGS

Standard's Box Jigs are made in either square or rectangular styles in 9 sizes. It will pay you to have them on hand in several sizes.

MILL FIXTURE BASES

Mill Fixture Bases are available in a variety of sizes. All are normalized and precision-machined. They are furnished with either standard keyways, or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost.



"Sure-Lock" Fixture Keys shown in our catalog

WRITE FOR YOUR COPY

FREE CATALOG

illustrating our complete line of top quality jig and fixture parts.

AUTOMATION NOTE: Also Custom-Built Precision Parts for Automation Tooling. Ask us.

STANDARD PARTS CO.

1012 BROADWAY • BEDFORD, OHIO

INDICATE A-3-228-2

cuts up to 4¼ in. in depth, the blade thickness is 0.095 in. Blades of 0.0625 in. also are available.

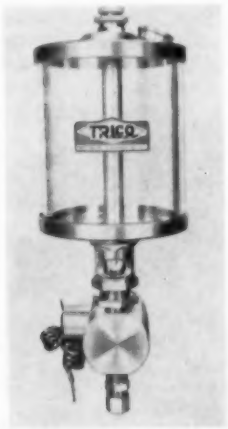
The vertically-hung blade prevents tool chatter and creates little heat. The tool is especally stable when making interrupted cuts, as on hexagonal, octagonal and square workpieces. Blades and holders are available for cuts up to 4¼ in. deep. Serrations on holders and shanks permit fine adjustments. Blade sharpening is easily accomplished with one or two passes over any tool grinding wheel.

Wye-Stanley Tool Co., 3503 E. Olympic Blvd., Los Angeles 23, Calif.

T-3-2291

Gravity Feed Oilers

"Dry starts" of machinery that has been shut down may be avoided by using the Kwik-Flush gravity-feed oiler. A special reservoir built into the oiler automatically floods bearing with approximately ⅛ oz. of lubricant as soon as the oiler valve is opened. Following the flushing cycle, the oiler functions in



a normal manner, feeding lubricant drop by drop at any required rate. While machine is idle, it again stores up oil for the next flushing cycle.

Kwik-Flush oilers are available in 10-oz, 1-pt, 1-qt and 2½-qt capacities, with either heat-resisting Pyrex or shatterproof Lucite reservoirs and with manual or electric solenoid shut-off valves.

Trico Fuse Mfg. Co., Dept. TE, 2948 N. 5th St., Milwaukee 12, Wis.

T-3-2292

Automatic Polishing Machine

Either 2B roll mill sheets or formed flat surfaces can be polished to an equivalent #4 finish or better with this Model 43-R3 hydraulic automatic stroke polisher.

The unit employs an hydraulic system which powers a traveling head at from 80 to 90, 8-ft strokes per minute, with longer strokes possible. A buff roll mounted on the traveling head backs up the 6 in. wide abrasive belt with a soft pressure that gives a uniform finish. The stock table reciprocates

Unequalled Filtration for Metalworking

and ONLY Delpark HAS IT!

THE Filter-Matic TUBULAR SCREEN VACUUM FILTER

- FOR LOW MICRO-INCH FINISH REQUIREMENTS
- HIGH CAPACITY FLOW RATES
- MINIMUM SPACE REQUIREMENTS
- AUTOMATIC, SELF-CLEANING

FOR COOLANTS, CUTTING OILS, ROLLING OILS, SOLVENTS AND CLEANERS AND ALL LIQUIDS REQUIRING REMOVAL OF MINUTE PARTICLES.

Designed and developed by Delpark to answer an urgent need of industry . . . particularly in the metalworking field. The demand for this proves that Delpark's new filtration concept is opening the way to better filtration at less cost. Here again is proof that industry searching for better, more efficient filtration looks to Delpark . . .

FIRST in Filtration Advancement

Delpark

Backed by more than 40 years experience in industrial filtration

INDUSTRIAL FILTRATION COMPANY
20 INDUSTRIAL AVENUE
LEBANON, INDIANA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-229

Accuracy: to less than 50 millionths —

MAN... THAT'S MICRO-FINISH!

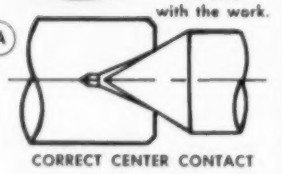
and, it's only possible with precision, anti-friction

RED-E GRINDER CENTERS

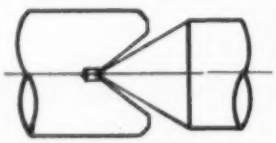
Chatter, wheel marks and out-of-roundness is caused by looseness in the center hole. The center and workpiece must be integral . . . rigid; the point in contact with the largest periphery of the centerhole, as illustrated in (a). Likewise, the bearing assembly must be able to provide great radial and thrust load capacities, with a minimum deflection under continuous operation.

If you're using anything but RED-E it's costing you money and you're not getting micro-finish!

Help yourself to super finishes. Read the new RED-E booklet "A New Concept In The Art of Grinding." Ask your Industrial Distributor for a copy today, or write direct.

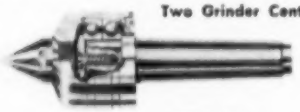


CORRECT CENTER CONTACT



INCORRECT CENTER CONTACT

Two Grinder Center Types



SHANK TYPE

SPINDLE TYPE

Only RED-E GRINDER CENTERS are constructed to meet these requirements because:

1. Bearing assemblies are locked in, Duplex ABEC-7 spec, Precision, Preloaded, Angular Contact New Departure ball bearings.
2. Points are of High Speed Steel, ground 60 degrees, 30 minutes included angle.
3. Lubricated for life.
4. Labyrinth enclosure keeps out all coolants.
5. Guaranteed.

TAPERS AVAILABLE

	Morse	B&S	Jarno	Norton	Landis
SHANK	1 to 6	5 to 15	4 to 20	10 to 16	.8125, 1.335, 1.750
SPINDLE	2 to 7	7 to 18	6 to 20	10 to 24	.8125, 1.335, 1.750

Special heads, tapers, shanks and points made to order.

CENTER *Specialists Since* 1908

RED-E-TOOLS **READY TOOL COMPANY**

558 Iranistan Ave. • Bridgeport 5, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-230

under the belt with grind pressure, either by manual or air-pressure control. The scratch pattern created is longer than mill-furnished standard No. 3 or No. 4 finishes, approximately a final finish.

The Model 43-R3 can be built to accommodate any length or width requirement. The machine also can be used for weld removal, surface cleaning prior to painting, scale removal, filler-sanding and many additional operations.

Curtis Machine Div., The Carborundum Co., Jamestown, N. Y. **T-3-2301**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Automatic Screw Machine

Two versions of the No. 00 automatic screw machines are intended for jobs which can be performed without reversing the machine spindle. Both machines have 18 spindle speeds ranging from 630 to 10,000 rpm, giving increased efficiency on free-machining materials and efficient operation on

tough alloys. One operating cycle feeds any length to 1 in. with 240 rpm driveshaft speed, or 2 in. with 120 rpm driveshaft speed. Greater lengths are fed by successive cycles.

Type 1 unit has a turret and vertical slide. It is designed for drilling, reaming, facing, turning, forming, knurling, cutting-off, etc.

Type 2 has no vertical slide, and the turret is replaced by a one-tool position slide. It is suitable for all types of form and cutoff work.

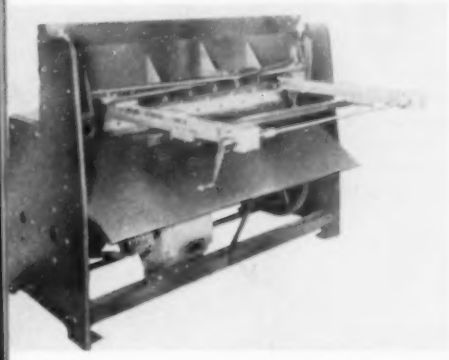
Both machines are of ½-in. capacity.

Brown & Sharpe Mfg. Co., Providence 1, R. I. **T-3-2302**

Squaring Shears

No. 72 series power squaring shears, in 36, 52 and 72 in. width capacities, will handle mild steel thickness up to 12 ga.

Three adjustable master springs above the spring hold-downs assure positive, nonslip grip. Gages at both front and rear of the machines have



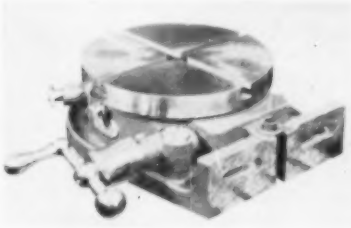
rapid-acting crank adjustments and calibrated scales for quick and accurate gage positioning.

Blades are made with four cutting edges and can be easily removed, turned over, or reversed to bring a new edge into use. Blade guards have clear plastic panels so operator can observe cutting area at all times.

Whitney Metal Tool Co., 724 Forbes St., Rockford, Ill. **T-3-2311**

Rotary Table

Designed to simplify circular and rotary machining operations, this rotary table features a base allowing both horizontal and vertical operation. Center-hole runout is no more than 0.0005 in. and parallelism through 360 deg of rotation is accurate to 0.0001 in. All flat working surfaces are ground square and the table rotates on a scraped flat bed. Provision is made for full lubrication of all working parts. Rotation mechanism can be disengaged for rapid hand rotation. Clamping ears and key slots are provided for fastening the unit to a machine table in the horizontal position. In the vertical position the unit is bolted to the machine table through elongated slots in the



TURNIT

TURNOVER ---------- HERE

Assures
50% LESS
TURNOVER HERE
where it really counts

TURNIT, makes *correct* rotation of diamond tools a simple effortless operation; saves 50% and more in diamond tool cost.

Now you can get a better wheel finish, closer work tolerance, longer wheel life and, at the same time, eliminate wheel glazing and minimize grinding wheel heat, cracks and fractures.

There is a TURNIT for almost every grinding application on all types and models of grinders. Whether you wish manual or automatic operation, internal or external installation call or write for recommendations.

For further information ask for your copy of the new Turnit bulletin.

J. K. Smit are also manufacturers of diamond tools, diamond wheels, diamond drill bits, diamond lapping compound and diamond powder.

J. K. SMIT & SONS, INC.
Murray Hill, N. J.
TORONTO • • • DETROIT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-231

DIAMONITE

offers all the essentials needed for successful machining with oxide cutting tools

Published reports on tests in numerous plants in the metal-working industry agree that there are four major requirements for successful performance of oxide cutting tools, namely:

1. Proper qualities in the tool itself.
2. Geometry, speeds and feeds adapted to the tool and work material.
3. Rigid tool support with well-distributed clamping.
4. Accurate, uniform chip control.

On the basis of these findings, Diamonite offers everything necessary for successful use of oxide tooling with a profitable pay-off of faster material removal, superior surface finish and long tool life.

- Diamonite Oxide Cutting Tools meet all requirements specified for successful performance. They are made of high purity aluminum oxide by advanced methods, resulting from more than 13 years of development and use of oxide tools. These processes have been specially developed to produce sapphire-like hardness and abrasion resistance with an ultra-strong bond unaffected by high temperatures and an extremely dense, highly-uniform, micro-fine grain structure.
- Diamonite offers charts of tool geometry, speeds and feeds based on years of practical machining experience, scientific computation and extensive research in the use of oxide cutting tools.
- The only holder especially designed for use with oxide tools, the Diamonite Superigid Tool Holder provides firm, uniform clamping pressure over a maximum area of the tool surface. It, thus, affords the rigid support and freedom from vibration essential to the use of oxide tools. It uses indexable throw-away lozenge inserts and permits micrometer adjustment of the chip breaker vital to oxide tool life and performance.
- The new Diamonite Oxide Chip Breaker, made of ultra-hard, abrasion - resistant Diamonite, will not crater and outwears other materials many times. It maintains the vital relationship between the chip breaker and tool cutting edge, assuring consistent chip control.

Your nearby Diamonite Tool Supplier has the tools and accessories and can furnish all the information you require to successfully and profitably use oxide tooling and you'll find him anxious to work with you to insure that you get best results. If you do not have his name, write for it today.

Have you ever considered using wear parts of Diamonite? Its extreme hardness and wear resistance assure extra long life and lowest end cost. Custom shapes can be made to your specifications. Send prints for quotation.

DIAMONITE products manufacturing company

pioneers in the development of oxide cutting tools

Canton 2, Ohio

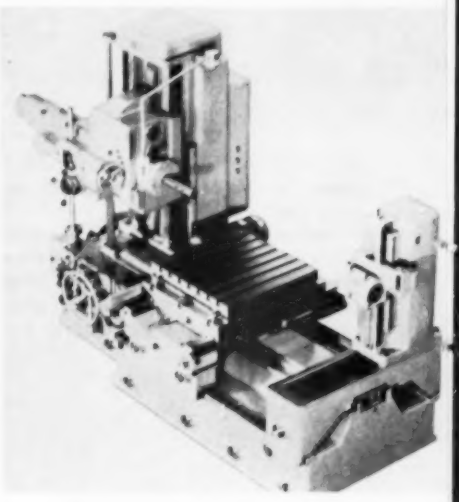
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-232

base. Over-all height in the horizontal position is 5 in. Over-all length is 15¼ in., and over-all width is 14 in. Table diameter is 12 in. The dial is graduated in minutes and the table in degrees. One turn of the dial gives 4 deg of circular motion of the table.

Universal Vise & Tool Co., Parma, Mich. **T-3-2321**

Toolroom Boring Mill

Projection screens are fitted to the vertical adjustment of the spindle slide and boring stay, and the transverse movement of the table to provide optical coordinate setting of the Optimetric toolroom boring mill. This system of optical measuring permits utilization



of the full degree of accuracy available in a machine of this capacity. Settings are accurate to 0.00025.

Wide bed support permits the table to be brought out at either extreme end without deflection.

Three sizes in the series are available: Model OA, 2½ in.; Model OB, 2¾ in.; and Model OC, 3 in.

Dept. PR-15, British Machines and Foundry Supplies, Ltd., subsidiary of British Industries Corp., Port Washington, N. Y. **T-3-2322**

Continuous Measuring Gage

Series 493-CG measuring gage continuously measures output of centerless grinders, and visually indicates any trend toward out-of-tolerance work so that as many as three or four machines can be supervised by a single operator.

The gage will respond to workpiece size only, since it incorporates a time delay response which is adjustable in

THE TOOL ENGINEER'S

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-3-256-1	Alina Corp.	Gages—Catalog contains data on line of precision measuring instruments. (Page 256)
A-3-208	American Pullmax Co., Inc.	Special Machines—Booklet describes Pullmax universal shearing and forming machine. (Page 208)
A-3-12	The American Tool Works Co.	Radial Drill—Bulletin No. 328 describes the new Model 32-speed Hole Wizard radial drill. (Page 12)
A-3-242	Armstrong-Blum Mfg. Co.	Cutting Tools—No. 8 Marvel band saw described in catalog. (Page 242)
A-3-314	Clausing Div., Atlas Press Co.	Lathes—Literature contains data on the Colchester clausing 13, 15, 17-in. geared head precision lathes. (Page 314)
A-3-277	The Atrax Co.	Cutting Tools—Catalog contains standard reference on solid carbide tools. (Page 277)
A-3-236	Aviation Developments Inc.	Components—Bulletin ADI-5500 contains engineering data on pip self-locking, quick-release pins. (Page 236)
A-3-356	The Bellows Co.	Cylinders—"The Story of The Bellows Air Motor" described in Bulletin BM-25. (Page 356)
A-3-336-2	Black Drill Co., Inc.	Cutting Tools—Operator's Manual shows engineering applications of "Hard-steel" drills. (Page 336)
A-3-357	The Bullard Co.	Lathes—Bullard Hydra-Feed lathe described in catalog. (Page 357)
A-3-188	Burg Tool Mfg. Co., Inc.	Turret Drill—Write Dept. TE-3 for engineering applications of Burgmaster 6-spindle turret drill. (Page 188)
A-3-329	Cadillac Gage Co.	Gages—Catalog contains data on Cadillac Pla-Chek gage line. (Page 329)
A-3-65	The Carpenter Steel Co.	Tool Steel—For facts on tool steel application, request "Step Ahead with Stentor." (Pages 64-65)
A-3-440-2	Central Safety Equipment Co.	Die Attachments—Bulletin 53 contains information on elasticones guide pin covers. (Page 440)
A-3-344-2	Collins Microflat Co., Inc.	Surface Plates—Bulletins contain data on Collins microflat black granite surface plates. (Page 344)
A-3-67	Cone Automatic Machine Co., Inc. Pilot Div.	Special Machine—Catalog contains data on Conomatic-Pilot hydraulic copying lathe. (Pages 66-67)
A-3-308-1	Covel Mfg. Co.	Grinders—Bulletin TE-27-10 describes Covel No. 10 surface grinder and Bulletin TE 27-14 describes Covel No. 14 optical comparator. (Page 308)
A-3-246-2	Arthur A. Crafts Co., Inc.	Carbide Form Tools—Catalog available on "Complete Carbide Tooling for Automation." (Page 246)
A-3-36	Danly Machine Specialties, Inc.	Die Set Data—Catalog contains design information on die sets and supplies. (Page 36)
A-3-317	Delta Power Tool Div. Rockwell Mfg. Co.	Drill Press—Operational facts contained in catalog on Delta drill presses, or booklet "Delta Power Tools Teamed with Machine Tools." (Page 317)
A-3-308-3	Detroit Stamping Co.	Fixture Components—De-Sta-Co Clamp-Omatics Model 810-U and 810-S described in booklet. (Page 308)
A-3-353	Ehrhardt Tool & Machine Co.	Gages and Dies—Booklet "Triple Plus" describes the Ehrhardt line of precision gages, dies and fixtures. (Page 353)
A-3-15	Federal Products Corp.	Indicators—Data on dial indicators contained in catalog. (Pages 14-15)
A-3-263-1	The Gaertner Scientific Corp.	Microscopes—Bulletin 161-4 shows applications, models and specifications for toolmakers' use. (Page 263)
A-3-412	Gardner-Denver Keller Tool Div.	Hole Production—Operational data on Keller Tool "Airfeedrills" and "Airfeedtappers" available in Bulletin 92. (Page 412)
A-3-270-1	Russell T. Gilman, Inc.	Machine Components—Catalog contains data on Gilman line of standard components for special machines. (Page 270)
A-3-406	George Gorton Machine Co.	Milling Machines—Form 2697-ADS describes super-speed vertical mills equipped with hydraulic controls. (Page 406)
A-3-215	Greaves Machine Tool Co.	Milling Machines—Comparison Chart contains data on Greaves Mills. (Page 215)
A-3-288	Hannifin Corp.	Riveters—Bulletin 150 contains engineering specifications on Hannifin "Hy-Power" Riveters. (Page 288)
A-3-254	Heinrich Tools, Inc.	Machine Components—Catalog contains engineering applications of Heinrich Grip-Master. (Page 254)

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

157 *THE TOOL ENGINEER DETROIT 38, MICH.*

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-3-250	The B. Jahn Mfg. Co.	Dies—Catalog contains case histories and engineering specifications of B. Jahn dies. (Page 250)
A-3-408-1	Jergens Tool Specialty Co.	Fixture Components—Engineering drawings and detailed specifications available in catalog. (Page 408)
A-3-354-3	Louis Levin & Son, Inc.	Turret Lathes—Catalog M describes line of instrument lathes, microdrilling equipment and accessories. (Page 354)
A-3-453-2	Logansport Machine Co., Inc.	Cylinders—Numerous catalogs on cylinders and special installations available on request. (Page 453)
A-3-354-2	Lovejoy Tool Co., Inc.	Cutting Tools—Catalog No. 35 contains data on new type "Z" Milling Cutters. (Page 354)
A-3-403	Mall Tool Co. Div. of Remington Arms Co., Inc.	Air Tools—Catalog illustrates and describes Mall air tools. (Page 403)
A-3-419	Mead Specialties Co.	Machine Components—Mead industrial air power catalog describes line of Mead air-operated devices. (Page 419)
A-3-322	Metal Carbides Corp.	Die Steel—Catalog 56-G contains data on Talide metal carbides. (Page 322)
A-3-421	National Tool Co.	Cutting Tools—Catalog describes National Tools' line of special tools for the metalworking industry. (Page 421)
A-3-246-1	New York Twist Drill Co., Inc.	Cutting Tools—Technical specifications and prices contained in catalog. (Page 246)
A-3-47	Niagara Machine & Tool Works	Presses—Bulletin on each size of standard OBI presses contain engineering specifications. (Pages 46-47)
A-3-313	Nice Ball Bearing Co.	Ball Bearings—Catalog No. 150 contains engineering specifications. (Page 313)
A-3-360-2	Novi Tool & Machine Co.	Tooling Attachments—Booklet describes Novi square slotted sleeves. (Page 360)
A-3-367	Ortman-Miller Machine Co.	Cylinders—Bulletin No. 105 describes removable Rod Gland Cartridge, exclusive with the 0-M series TH Hydraulic cylinder. (Page 367)
A-3-394	The Osborn Mfg. Co.	Brushes—Brushamatic booklet describes Osborn power brushing methods. (Page 394)
A-3-290-2	Petz-Emery Inc.	Indicators—Em-re dial indicators described in Catalog D. (Page 290)
A-3-324	Pines Engineering Co., Inc.	Cold Bending—Study data on production bending available in Pines News. (Page 324)
A-3-339	The Pipe Machinery Co.	Gages—Illustrated catalog describes range of PMCo ring gages. (Page 339)
A-3-218-2	Precision Tool & Mfg. Co.	Boring Tools—Literature describes Deka Bore offset boring head. (Page 218)
A-3-230	Ready Tool Co.	Superfinish—"A New Concept in the Art of Grinding" available upon request. (Page 230)
A-3-312	Seneca Falls Machine Co.	Special Machines—Bulletin CS-54 describes centering machine for tracer and automatic lathe production. (Page 312)
A-3-349	The Sheffield Corp.	Gaging—Precisionaire air gaging described in Bulletin IPC 6-56. (Page 349)
A-3-416	The Staples Tool Co.	Cutting Tools—Catalog contains engineering data on Staples Precision Carbide Tools. (Page 416)
A-3-200	Tomkins-Johnson Co.	Cylinders—Details of Spacemaker line contained in bulletin. (Page 200)
A-3-41	Universal Engineering Co.	Locating Pins—Locating pins and other Universal products described in catalog. (Page 41)
A-3-284-2	The Vaill Engineering Co.	Forming Machines—Bulletin T-1 describes Vaill tube end-forming machines. (Page 284)
A-3-282	The Van Keuren Co.	Gages—Catalog and handbook No. 36 contains technical engineering information on measuring problems and methods. (Page 282)
A-3-407	Waldes-Kohinoor, Inc.	Grooving Tool—Manual contains data on Waldes Truarc grooving tool. (Page 407)
A-3-220	Wendt-Sonis Co.	Cutting Tools—Catalog 56 describes Wendt-Sonis cutting tools. (Page 220)
A-3-257	Wilson Mechanical Instrument Div. American Chain & Cable	Testers—Booklet DH-328 describes Wilson "Tukon" microhardness testers; Bulletin DH-325 describes Wilson "Rockwell" hardness testers. (Page 257)
A-3-296-2	W. M. Ziegler Tool Co.	Cutting Tools—Catalog contains data on Ziegler roller drive floating holder. (Page 296)

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

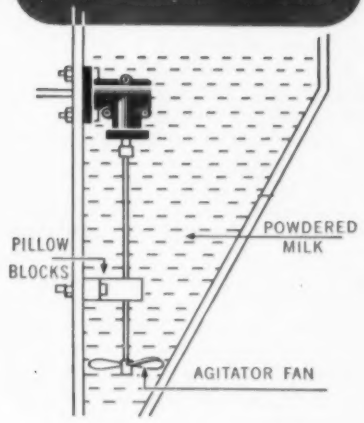
FIRST CLASS
PERMIT NO. 10782
(Sec. 34.9, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 38, Mich.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

ANGLgear solves contamination problem



Simplified drawing shows how ANGLgear drives discharge agitator fan in a powdered milk bin. ANGLgear's sealed lubricant feature protects product from contamination.

A well-known candy manufacturer needed a 90° power take-off to drive an agitator inside a powdered milk bin. Trouble was the lubricant from ordinary miter gears would contaminate the product.

The only answer seemed to be a costly nonstock drive with special seals . . . until company engineers learned about ANGLgear.

A standard Model R320 ANGLgear—completely enclosed, permanently lubricated — not only licked the contamination problem but also was inexpensive and easy to install.

Standardized ANGLgear is a simple, compact, positive 90° drive suitable for either manual or power operated systems. ANGLgear is available from stock in 1 to 5 hp ratings, with 2- or 3-way shafting, and 1:1 or 2:1 gearing.

See our literature in Sweet's Product Design File; then contact your local distributor or write direct.

AIRBORNE®

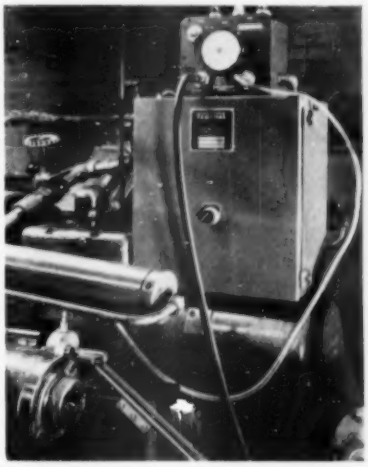
AIRBORNE ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY

INDICATE A-3-235-1

accordance with the speed of work travel and piece length. This time delay provision produces a steady, uninterrupted signal which indicates condition of the work. Trends toward borderline work sizes are indicated by lights on top of the meter-switch unit. The gage can also be equipped with audible signals.

Indicating limits can be set within the spread of the tolerance so that the operator will be signalled before any oversize or undersize work is produced. The indicating dial is graduated in 0.000050 in. and the air-electric system



used in the gage permits indicating limits to operate consistently within ± 0.000005 of their established settings.

The gage is comprised of standardized components and is normally supplied with an air snap gaging head which can be equipped either with various size spacing blocks to suit a variety of work sizes or with an air ring gaging head, as in the illustration.

Both types of heads provide noncontact measurement.

Federal Products Corp., 1144 Eddy St., Providence 1, R. I. **T-3-2351**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Finishing Machines

Coated abrasive belts are used as cutting tools in the Straight-O-Matic line of grinding, polishing and deburring machines.

Model R600C-3, illustrated, employs three 10-in. wide abrasive belts over one conveyor belt and is equipped for wet grinding. Oil mist applicator, automatic tracking and pneumatic tensioning of the belts are other important features. The unit permits a three-grit polishing sequence, a three-step stock removal for sizing, or combinations of

Special Size Reamers ARE STANDARD WITH L&I.

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .1230 thru .4995" Sets, too!

OVER & UNDER SIZE CHUCKING REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .124 thru .501" Sets, too!

These reamers are two more reasons why L&I is the source for a complete reamer line.

See your L&I Distributor.

L&I

"the reamer specialists"

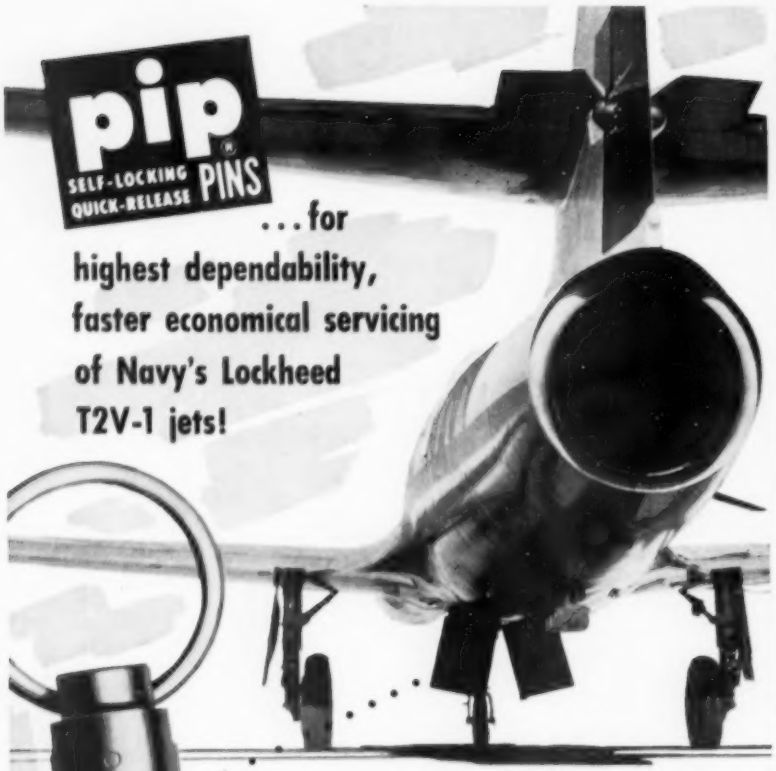
LAVALLEE & IDE, INC.

CHICOPEE, MASS.

INDICATE A-3-235-2

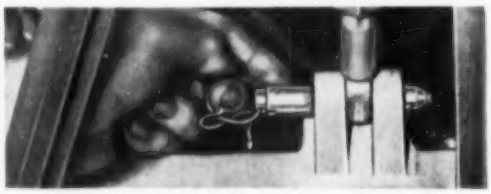
pip
SELF-LOCKING QUICK-RELEASE PINS

...for highest dependability, faster economical servicing of Navy's Lockheed T2V-1 jets!



Dive flap attachment, servicing and interchangeability simplified with double-acting "B" type PIP Pins!

PIP Pin connection of hydraulic actuator to dive brake fitting answers Lockheed's design requirements for a safe, trouble-free lock pin capable of withstanding high shear loads and providing quick removal and interchangeability of the dive flap assembly without requiring nuts, washers, safety cotters, etc. In addition, PIP Pins offer drive-in drive-out features for easy insertion or removal when hole misalignment or normal structural variations bind the pin. A blow on the head or tip with a plastic mallet permits retaining balls to recede into body of pin as pin drifts in or out.



PIP—Reg. U. S. Pat. Off.
Patented

Model "B" PIP Pins in Lockheed's T2V-1 dive brake assembly take direct opening and retraction loads—give trouble-free operations. A pull on the heavy-duty continuous steel ring effects fast removal.

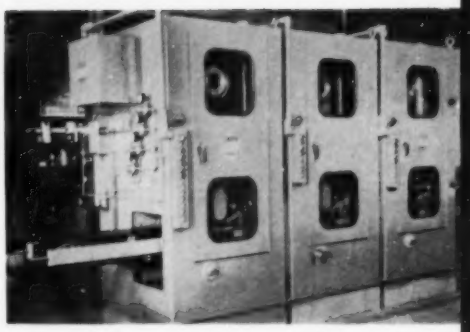
PIP pins are available in sizes to most bolt standards and in "T," "L," Ring and Button head styles.

For complete information write for Bulletin A01-5500

AVIATION DEVELOPMENTS INC.
210 SOUTH VICTORY BOULEVARD, BURBANK, CALIFORNIA

Burbank • Chicago • Dayton • Fort Worth • Kansas City • London, England • Los Angeles • San Francisco • Seattle • Toronto, Canada • Wichita

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-236



polishing and grinding.

The Neoprene-rubber conveyor belt allows for relatively close-tolerance work. One user reports holding tolerance of ±0.001 on business machine parts. Fixtures may be attached easily to the conveyor belt.

Curtis Machine Div., The Carborundum Co., Jamestown, N. Y. **T-3-2361**

Nutsetters

Capacities up to ½ in. bolt size are accommodated by these air-powered right-angle nutsetters which are light in weight, simple in design and have extra power.

These nutsetters, with direct drive, are available in six models and two types: No. 4RDC heavy-duty type in speeds of 350, 600, 1,100 and 1,300 rpm, and No. 4RDXC models in speeds

of 800 and 1,300 rpm. The latter two models are equipped with small right-angle attachments for use in close quarters.

The tools have unit type attachments, interchangeable from one machine to another.

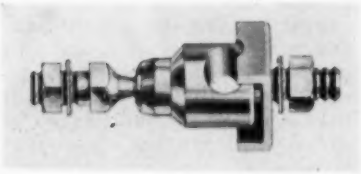
Angle-type nut setting attachments are keyed to slots in the gear case at 90 degree intervals, permitting positive locking of the attachment.

Thor Power Tool Co., Aurora, Ill. **T-3-2362**

Ball Joint

Design of this Type EC ball joint is such that the ball socket is in the same unit as the cross-drilled hole, thus providing added wall thickness. A specially designed ball stud with a short neck enables more than 250 lb of force to be applied on this unit.

In the swivel construction, a grease-resistant neoprene washer cushions movement and maintains proper tension. A spring clip allows rapid adjustment over great length, and



threaded rods and conventional set-screws are not needed. Nut, lockwasher, and spring clip are permanently assembled on the unit.

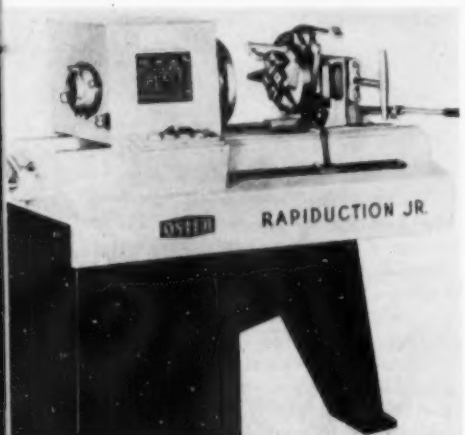
J. J. Tourek Mfg. Co., 1901 S. Kilbourn Ave., Chicago 23, Ill. **T-3-2371**

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Threading Machine

A line of threading machines, designated the Rapiduction Jr., comprises four machines of the same basic design but with different types of die-heads to permit selection of the most suitable machine for a specific job.

Model No. 792, primarily a pipe threading machine of ⅛ to 2" capacity, will also thread bolts and rods from ¼ to 2 in. diameter. Two types of die-heads are offered: one using hobbed, radial type dies and the other tangential type dies. The die-heads are furnished in two sizes, one for ⅛ to ¾ in. pipe and othe other for 1 to 2 in. pipe. A gripping chuck, the Power-Matic, is standard equipment on the No. 792.



Model No. 792-R, with manually operated revolving, radial-type die-head and open-type vise to hold work stationary, is designed to thread pipe, rods or bolts after beading. Threading capacity for both pipe and solid stock is the same as for the No. 792, and it can be equipped with a ream or ream-and-chamfer device which works simultaneously with the threading operation.

Two other models, Nos. 791-A and 792-A, are primarily bolt and rod threading machines and are designed with semi-automatic, revolving die-heads of the radial type. An automatic tripping device opens the die-head when the thread has reached the desired length and resets it to the same size for duplicate threads. These models also utilize the open-type vice and ream and chamfer tools, and can be used for pipe and nipple threading.

No. 791-A has a bolt range from ¼ to 1½ in. and pipe or nipple range from ⅛ to 1¼ in., while the No. 792-A will thread bolts from ¼ to 2 in. and pipe and nipples from ⅛ to 2 in. in diameter.

The Oster Mfg. Co., E. 289th and Nickel Plate R.R., Wicklyfe, Ohio. **T-3-2372**

Expander Machine

The #15-H-215 expander, with a peak draw bar pull of 215 tons at maximum hydraulic system pressure of 3000 psi, is the first of the H series of such equipment with capacities from 60 to 1450 tons draw-bar pull. The unit offers flexibility as to range of shapes and sizes of parts that can be handled in one basic machine by interchanging the draw bar, cone, jaws and table. Primarily, it is useful in forming and sizing cylindrical, conical and polygonal sheet metal parts or tubing to an accuracy of 0.004 in. TIR.

The unit is designed for both light weight and strength. Cast-iron piston and gland rings are used and a supplementary gland seal is combined with a

because- The bodies of Futurmill cutters are built to hold solid carbide blades with maximum tool rigidity—and these same cutter bodies may be used for many various milling and material applications. They cut tough alloy steels, soft or brittle materials; they perform most accurately at the highest feeds and speeds obtainable; they eject chips properly; they may be used indefinitely.

because- By employing inexpensive standard solid carbide lathe blanks and "throw-away" blanks as the cutting element (blades) the Futurmill model X reduces the perishable expense (or cost per cubic inch of material removal) to the lowest milling costs known **TODAY!**

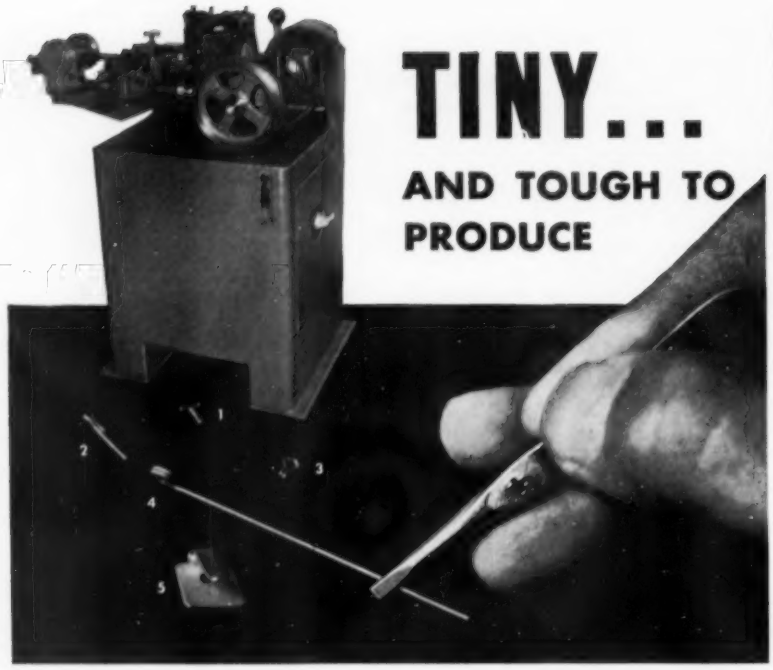
because- Coupled with the Futurmill principles of ease and accuracy of indexability and the elimination of cutter or blade grinding and regrinding, model X presents the metal worker with a tool for modern milling requirements . . . without the burdens of the past.

For further information and literature; write

futurmill, inc. DETROIT MILLING CUTTER Division

28625 Grand River • Farmington, Michigan • Greenleaf 4-5745—4-8450

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-237



TINY...

AND TOUGH TO PRODUCE

INTRICATE FORMING IS AUTOMATIC ON A NILSON 4-SLIDE

Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 **Mercury Switch Part** . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 **Electrical Contact** . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 **Swivel Part** . . . .025" brass wire. Heading operation includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 **Leadwire** . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 **Contact Part** . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to 1/2", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step to increased production.

A.H. NILSON MACHINE COMPANY

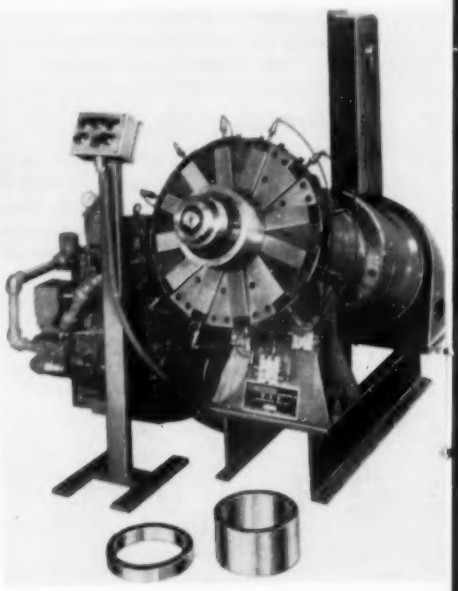
1520 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-238

bleed-off back to the oil reservoir. A duplex type variable-delivery pump, reservoir, oil cooler, piping and valves comprise the hydraulic system which is capable of operating the machine at from two to six complete cycles per minute. Expanding rate can be varied by means of a pilot-motor-operated adjustment. Jaw-cone and jaw-table contact surfaces are automatically force-lubricated. Jaw diameter is infinitely adjustable within the diameter range.

These expanders can be installed so as to operate in a vertical, horizontal or oblique position, depending on the



size and type of jaws and cone. With the draw bar and cone arrangement illustrated, 2½ sq in. of stainless steel having a yield strength of 100,000 psi can be expanded. The test part shown is 1045 steel, having an ID of 8 in., a cross sectional area of 4.55 sq in. and a yield strength of 60,000 psi. This part is shown placed directly on the jaws. Normally, tool steel dies are used between jaws and the part.

Grotnes Machine Works, Inc., 5454 N. Wolcott Ave., Chicago 40, Ill.

T-3-2381

Broaching Fixture

Automatic broach handling and part ejection devices to provide semiautomatic loading are incorporated in this self-contained, air-powered broaching fixture. It has a tandem air-hydraulic cylinder that pulls the broach through the part, and a second air cylinder which operates a broach retriever mechanism. A third air cylinder operates a part ejection device.

The unit illustrated broaches a round hole in each of two 3/8-in. dia, 1-in.

long bushings that are pressed in a die-cast electric windshield wiper bracket. The in-line bushings are about 4-in. apart. The holes are broached to a 0.001-in. diam tolerance and must be in line within 0.0005-in. A combination broach-burnisher tool is used in an 8-sec. machining cycle.

The unit has a 25-in. stroke. Maximum pull force of the fixture is 1450 lb, and maximum broach speed is 70 fpm. The fixture is designed to be bench-mounted, or it can be furnished with a welded steel base and coolant supply pump.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

T-3-2391

USE READER SERVICE CARD ON PAGE 233 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Miniature Chuck

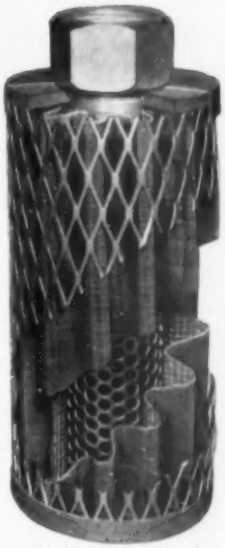
Designed particularly for drilling in close quarters, this drill chuck produces an unusually firm grip on full-length of broken drills. The tool, called the Mini-Chuck, has a specially designed cut-back slot which permits a full tension grip of the drill to prevent slippage and pullouts. The only replacement required is the drill itself.

Mini-Chuck is available in a full range of chuck sizes with adapters to fit spindles of standard angle-head and snake drills.

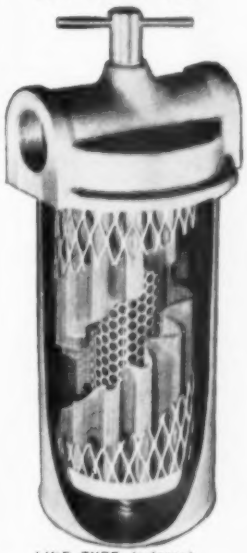
Beaver Tool Co., Box 256, Huntington, L. I., N. Y. **T-3-2392**

Here's What Users Have to Say About

MARVEL *Synclinal* FILTERS



SUMP PUMP (cutaway)



LINE TYPE (cutaway)

Catalogs containing complete data available on request

U. S. STEEL CO., Irvin Works Three-Stand Cold Reduction Mill—"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines".

JONES & LAUGHLIN STEEL CORP., Aliquippa Works—"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size".

MANY OTHERS REPORTING SIMILAR RESULTS ARE NOW SPECIFYING MARVEL SYNCLINAL FILTERS ON ALL NEW HYDRAULIC EQUIPMENT—AND STANDARDIZING WITH MARVEL SYNCLINAL FILTERS ON ALL EXISTING EQUIPMENT

For Dependable Protection on All Hydraulic and Other Low Pressure Circulating Systems —Investigate MARVEL SYNCLINAL FILTERS

OVER 750
Original Equipment Manufacturers Install them as Standard Equipment!

They Meet J. I. C. Standards

FILTERS FOR ALL TYPES OF FIRE-RESISTANT HYDRAULIC FLUIDS
Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

WATER FILTERS
Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

A SIZE FOR EVERY NEED
Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY
As in the past, Marvel continues to offer Immediate Delivery!

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill.

Phone: JUniper 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name _____

Address _____

City _____

State _____ TE-3

HY-PRO specialized tap engineering tells you

which tap where

for lowest cost per hole

New alloys, new plastics, new tooling set-ups, and mounting production demands pose new problems daily in tap selection and use. HY-PRO tap engineering service provides prompt answers . . . the *right* answers that mean steady savings in tap expense, in time loss on the line, in reduced parts spoilage.

in plastics

Abrasive composition of most hard plastics requires Hy-Pro's multi-fluted design, .0025 oversize, with the exclusive Hy-Pro "Hardernell" finish for maximum wear resistance and free-cutting.

in die castings

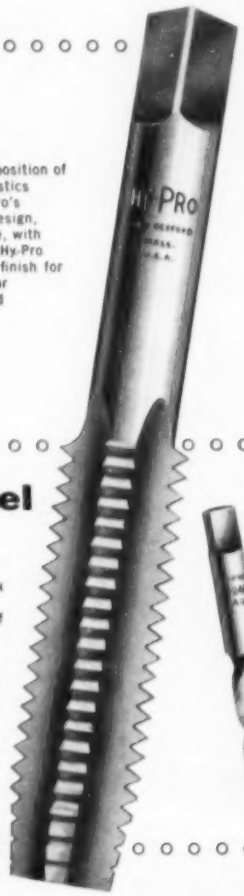
Relative softness of alloys used causes tendency to close in and bind the tap. Hy-Pro's 2 flute spiral point oversize design meets these conditions, — provides free-tapping, clean threads.

in stainless steel

Hy-Pro spiral point design provides high-hook angle for most efficient cutting of this metal, and maximum tap strength. Ferrox surface treatment counteracts chip welding.

in aluminum

Hy-Pro's spiral (1) flute tap lifts chips out, gives best results in blind holes. Hy-Pro's spiral point design (2) is recommended for through holes. Chrome plate or nitride surface treatment resists abrasive effect of most aluminum alloys.



What's your tapping problem?

Hy-Pro Tap Engineering Specialists can help you correct tapping troubles — and can often point out opportunities to cut costs in tapping operations you've considered satisfactory. It costs nothing to consult Hy-Pro Specialists, and records prove that in 8 out of 10 cases, their advice will pay steady dividends in savings. Write or phone: Hy-Pro Tool Company, Dept. C, New Bedford, Mass.

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR**
FOR STANDARD TAPS FROM STOCK
SPECIAL TAPS MADE TO ORDER

HY-PRO

REG. U. S. PAT. OFF.

TAP ENGINEERING SPECIALISTS

HY-PRO TOOL COMPANY · NEW BEDFORD, MASS., U. S. A.

Men at Work

Henry M. Haase, vice-president in charge of engineering and research for Borg-Warner Corp., was recently elected president and chief executive officer of the corporation's York Div. He will continue as a vice-president of the parent company, but will not direct its research and engineering activities.

At the same time Borg-Warner made public the elevation of **Stewart E. Lauer** to the chairmanship of the board of the York Div. He has been president for the past 16 years.

Clayton E. Scott, chief engineer of the machine and tool section, has been made plant manager of Michigan Tool Co.'s Six Mile Rd. plant in Detroit. He is succeeded in his previous post by **Richard S. Hildreth** who has been an assistant to the post. Mr. Hildreth is a member of ASTE's Detroit chapter.

Eclipse Counterbore Co. recently announced election of officers for 1957. **Roy G. Mitchell,** formerly president, is chairman of the board of directors; **Herbert R. White,** former vice-president, is president and general manager; and **I. A. Homrich,** was elected vice-president in charge of manufacturing; and **Austin P. Smith** was made vice-president in charge of engineering. Mr. Michell and Mr. Smith both are members of ASTE's Detroit chapter.

Leo J. Brancato was appointed a vice-president of Heli-Coil Corp. Chief engineer in charge of product development and research for the company since October 1954, he will continue to head the engineering department in addition to new corporate duties.

Robert E. Ward has been named director of manufacturing of The New York Air Brake Co. where he will be responsible for organization policies, procedures and manufacturing programs of all division manufacturing departments.

Ten vice-presidents elected by the Society of Automotive Engineers to serve with new president Eddy include: **W. C. Lawrence** of American Airlines, Inc.; **J. H. Famme** of Convair Div. of General Dynamics Corp.; **R. E. Johnson** of Wright Aeronautical Div. of Curtiss-Wright Corp.; **H. C. Grebe** of Ford Motor Co.; **M. R. Bennett,** International Harvester Co.; **M. L. Frey,** Allis-Chalmers Mfg. Co.; **C. J. Livingstone,** Gulf Oil Corp.; **L. H. Nagler,** American Motors Corp.; **D. S. Kimball, Jr.,** Bendix-Westinghouse Automotive Air Brake Co.; **W. W. Henning,** International Harvester Co.; **Henry Jennings,** McGraw-Hill Publishing Co., Inc.; and **S. J. Tompkins,** Dodge Div. of Chrysler Corp.

Election of **A. D. Moncrieff** as a vice-president has been announced by Michigan Tool Co. Formerly he was manufacturing manager of the machine tool and cutting tool division. Mr. Moncrieff has authored several articles for THE TOOL ENGINEER.

Concurrently with Mr. Stine's appointment as president, Pangborn Corp. made public the election of **Ralph M. Trent** as director and executive vice-president and **W. O. Vedder** as vice-president. **Thomas W. Pangborn,** founder and president of the corporation since 1904, will continue to serve as chairman of the board, while **John C. Pangborn,** former first vice-president will fill the office of vice-chairman of the board.

In addition to electing Mr. Avery as president, Acme Steel Co.'s board made **Fred M. Gillies** chairman of the board and chief executive officer. **Carl J. Sharp,** former chairman, continues as chairman of the executive committee.

According to The Bullard Co., **John P. Poth** has joined the organization to fill the recently created position of director of engineering. He formerly was vice-president of engineering at the Engineering and Research Corp. and engineering manager of Erco, a division of A.C.F. Industries, Inc.

W. Paul Eddy, chief of engineering operations for Pratt & Whitney Aircraft Div. of United Aircraft Corp. was elected to serve as president of the Society of Automotive Engineers for 1957.

Guy T. Avery is new president and chief administration officer of Acme Steel Co. A member of the Acme organization for 36 years, he has been its executive vice-president since 1953.

Manuel F. Diaz was elected president of Wesson Tool Co. to succeed Ernest Mortensen who retired. Mr. Diaz also continues as a director of three of the six firms in the Wesson group.

Victor F. Stine, vice-president in charge of sales and engineering for Pangborn Corp. since 1941, has been elected president of the company. He has been a director since 1951.

Board of directors of Detroit Power Screwdriver have elected **Roy W. Bailey** to the offices of president and treasurer of the company. Mr. Bailey is a member of ASTE's Detroit chapter. At the same time, the board elected **Robert F. Gladfelter** to the post of vice-president of sales and secretary, and **John M. Small,** vice-president in charge of manufacturing.

Lyman A. Bliss is now president of Union Carbide Nuclear Co., a division of Union Carbide and Carbon Corp. Formerly vice-president of the company, he now succeeds **Kenneth Rush,** a vice-president of Union Carbide and Carbon Corp., who will continue to have overall responsibility for the corporation's nuclear and international activities.

John Moxon, vice-president, treasurer and secretary of The Carpenter Steel Co., has been elected to the office of executive vice-president. He also will continue as a member of the board.

Alonzo A. Neese was named chairman of the board of Warner Electric Brake & Clutch Co. He is vice-president and director of Beloit Iron Works and vice-president of Beloit International.

Edward W. Forth, formerly vice-president in charge of manufacturing of American Machine & Foundry Co.'s subsidiary, DeWalt Inc., is now vice-president and general manager, AMF Cycle Co.

Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal

Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.
Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.
Only a No. 8 MARVEL can do all of these things: Snip-off a ½" rod or cut-off an 18" x 18" cross section.
Rough to Size and Shape
Miter
Index
cut off and shape Structural Beams
Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures, etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

Metal Cutting MARVEL SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-242

Executive changes at H. K. Porter Co., Inc. involved **T. M. Evans,** president, who was elected chairman, and **Charles L. Holbert,** executive vice-president, who was elected president of the company.

Recent major executive promotion at The Carpenter Steel Co. involved **Carl B. Post,** vice-president and technical director, who was elected to the board of directors.

Five vice-presidents recently were elected by the board of directors of The Carborundum Co. **Niles C. Bartholomew,** formerly vice-president of the subsidiary Carborundum Metals Co., Inc., continues as general manager of the firm which now is designated a division of the parent company. **Gene DeMambro** was president of Curtis Machine Corp. a subsidiary, which now has become a division of Carborundum. He will be in charge of the division as general manager. **I. Wendell Hamm,** will continue to direct activities of the manufacturing division of the functional staff. **Joseph S. Imirie** will continue as general manager of the Electro Minerals Div. **Leslie E. Simon,** Major General U.S. Army (Ret.), continues as director of the Research and Development Div.

Four executive promotions were announced by Crane Packing Co. **Carl E. Schmitz,** formerly vice-president in charge of sales, was named executive vice-president; Mr. Schmitz is a member of ASTE's Chicago chapter. **Vance E. Vorhees** was promoted to vice-president in charge of sales from assistant general sales manager. Former works manager **B. H. Stenberg** was named vice-president in charge of manufacturing. **E. H. Stubenrauch** was named to the post of assistant general sales manager from divisional sales manager.

Harry E. Cheseborough was named director of product planning for Chrysler Corp. A member of the Chrysler organization for 25 years, he has been serving as executive engineer in charge of product planning in the engineering division for the past two years.

F. S. Mitchell, formerly staff executive in Chrysler Corp.'s stamping and general manufacturing group, has been promoted to plant manager of the company's Eight Mile Rd. plant in Detroit.

Former supervisor of production control activities at the Mound Road engine plant, **Vernon A. Albaugh** has been promoted to manager of production control for Chrysler Corp.'s Engine Div.

Crucible Steel Co. of America has appointed **Reinhold Schempp** manager of the Sanderson Halcomb Works in Syracuse, N.Y., and **S. A. Fronek** as head of the Park Works in Pittsburg. Each previously served as assistant manager of his respective plant.

Joseph F. Quaas is now vice-president in charge of manufacturing and production for Eutectic Welding Alloys Corp. Since joining the company in 1950 he has been a member of Eutectic's research and production team.

Melvin D. Verson was recently made vice-president/marketing for Verson Allsteel Press Co. He has been serving as assistant to the president.

Sahlin Engineering Co., Inc. has made **William H. Uren** operations manager of the company. Formerly purchasing agent, he has been with Sahlin for four years.

Appointment of **James O. Dague** as superintendent of Bethlehem Steel Co.'s Lackawanna, N.Y. plant has been announced. He has been assistant superintendent since 1949.

Roy O. Schiebel was recently elected to fill the newly created position of second vice-president, sales and marketing of Magnaflux Corp.

Appointment of **Steven S. Gordon** as assistant general manager of Republic Gear Co. has been made public by Gear Grinding Machine Co.

Former sales manager **Warren F. Bice** has been made general manager of The Progressive Mfg. Co., Div. of The Torrington Co. He succeeds **Ralph H. Perry** who retired after 40 years' association with the fastener industry.

H. D. Bryk is now manager of operations of Alloy Precision Castings Co. He was assistant to the executive vice-president and general manager.

BEFORE RIVETING YOURSELF INTO A CORNER

. . . check with Milford Engineers!

Riveting raises *special* problems and requires *special* skills. You must have the right type and size rivet for each application, or the results can be costly . . . in production and in profits. When you're faced with a riveting problem, let Milford engineers lend a hand before designs are fixed!

To improve product appearance and strength
. . . to take full advantage of automatic assembly
. . . to cut delivery time and production costs
—get in touch with Milford first!

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-243

Trade Literature

for free booklets and catalogs—use convenient request card, page 233

Slitters

Illustrated 76-page reference and handbook, "Multiple Rotary Slitting Lines", gives information on all types and sizes of slitters and allied equipment. Part I offers basic information on design, selection and operation; Part II deals with specifications, capacity tables and other data. The Yoder Co., 5500 Walworth Ave., Cleveland 2, Ohio. **L-3-1**

Carbide End Mills

Revised Catalog No. 601 offers information on solid carbide end mills including data such as diameter, flute radius, shank diameter and over-all length on 11 different types of mills; also has information on high-speed steel and carbide rotary cutters, countersinks and special tools; includes price list. M. A. Ford Mfg. Co., Davenport, Iowa. **L-3-2**

Stub Arbor

Catalog sheet shows construction, advantageous features and uses of the Peterson stub arbors which are used on milling machines to automatically center tools. Sierra Machine Co., 4th & Dwight Way, Berkeley 10, Calif. **L-3-3**

Electric Cutting

Extensively illustrated 4-page folder presents data on the Arcair process and the use of the Arcair torch for cutting, gouging, beveling or grooving of metals; outlines applications for the torch and gives data on Arcair electrodes. Arcair Co., 419 S. Mt. Pleasant St., Lancaster, Ohio. **L-3-4**

Machine Knives

Thirty-two page brochure offers reference data on several types of machine knives and edge tools; extensively illustrated by engineering drawings. Alcon Production Tool Co., 579 Baird St., Akron 11, Ohio **L-3-5**

Brush Finishing

Complete story of Brushmatic finishing is presented in 21-page, extensively illustrated brochure, "Brushmatic, How to Improve Finishing the Osborn Way;" shows actual on-the-job operations, parts, before and after finishing; charts aid in selection of proper brush for various jobs. The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. **L-3-6**

Electric Weld Tube Mill

Use of modern tube mills in manufacture of pipe and tube described in 64-page handbook, "Electric Resistance Weld Tube Mills"; gives step-by-step discussion of electric-weld process; photos, drawings and charts illustrate operation, capacities and applications of electric-weld tube mills of various sizes. The Yoder Co., 5500 Walworth Ave., Cleveland 2, Ohio. **L-3-7**

Milling Cutters and Inserts

Four-page folder covers pertinent details of RC milling cutters and the throw away carbide inserts used in them, emphasizing economy; illustrated by drawings; includes specification and price lists. Newcomer Products, Inc., Latrobe, Pa. **L-3-8**

YOU GET SPEED PLUS ACCURACY WITH MOORE JIG GRINDERS

HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time
Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¼ hours.*

CONTOURS, Too, Accurately Jig Ground and Checked in One Setting
This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

MOORE SPECIAL TOOL COMPANY, INC.
732 Union Ave., Bridgeport 7, Conn.

NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS · DIE FLIPPERS · MOTORIZED CENTERS · HOLE LOCATION ACCESSORIES
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-244

Chemical Milling

Tooling requirements for chemical milling process specified in detail in Design Bulletin No. 3; outlines three optional procedures for producing templates required to chemically mill flat or formed parts in aluminum and magnesium. Request only on company letterhead direct from United States Chemical Milling Corp., 1700 Rosecrans Ave., Manhattan Beach, Calif.

Turks Head

Complete line of turks heads described and illustrated in Catalog No. TH56 contains basic technical information, principles of operation and advantages as a precision production machine; explains typical wire shaping applications; includes specifications of types, sizes and technical operating data. Fenn Mfg. Co., Fenn Rd., Newington, Conn. **L-3-9**

Adapter Fittings

Twelve-page Catalog 4360 shows straight thread plugs and adapters, O-rings for straight thread fittings and steel and brass pipe fittings. Tube & Hose Fittings Div., Parker Appliance Co., 17325 Euclid Ave., Cleveland 13, Ohio. **L-3-10**

Steel Heat Treating

Sixteen page booklet dealing with heat treating or pickling of stainless steel offers operating data for annealing and handling, provides physical property data, and discusses useful information on heating, pickling and descaling. Crucible Steel Co. of America, Dept. T., The Oliver Bldg., Mellon Square, Pittsburgh 22, Pa. **L-3-11**

Machinery Parts

Booklet on machinery parts includes data on chemical compositions, physical and mechanical properties, corrosion resistance and machining of Haynes alloy parts; case histories show use of parts of both standard and special design; other sections give details of procedures for heat-treating, machining, grinding and forming machinery parts. Haynes Stellite Co., Adv. Distribution Section, 30-20 Thomson Ave., Long Island City 1, N. Y. **L-3-12**

Squaring Shears

Comprehensive 74-page Bulletin No. 69G covers line of underdrive power squaring shears; describes construction, and important features of equipment; photos of job applications show shears at work for mass producers, fabricating plants, steel warehouses and sheet metal shops; includes tables of specifications. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. **L-3-13**

HOW USERS OF THE *Lusol* LINE TEST COOLANT DILUTIONS RIGHT AT THE MACHINE IN 60 SECONDS

If your coolant dilution is too lean, you run the risk of rust; if it is too rich, you get stickiness and, what is more, you are wasting coolant and throwing money down the drain. Without checking, it is easy to throw your balance off as much as 50%. A regular laboratory analysis takes a good deal of time, but with this "concentration kit", users of the Lusol Line of coolants get the answers in 60 seconds. That's why users of Lusol products have no trouble in maintaining correct dilutions, and one good reason why they always get better results, greater machining accuracy, longer tool life, longer production runs. Investigate this unique and important control feature. A demonstration is yours for the asking.

Are you guessing?

- What coolant "mix" do you require? 20 to 1, 50 to 1, 100 to 1?
- Are you maintaining this dilution?
- This kit gives the answer to users of the Lusol Line in just 60 seconds.
- Let us demonstrate in your plant.

Send today for 16 page descriptive booklet

THE *Lusol* LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY, INC.
BOX 213, PORTLAND, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-245

The Drill Sarge Says...

"New York Twist Drill supplies Aircraft Standards (NAS) A, B & C types

AT NO EXTRA COST!

Meeting the strict specifications of National Aircraft Standards, NEW YORK's Type A, B and C twist drills are specially designed for heavy duty drilling. Their sturdy construction and precision points last longer and give greater production . . . Best of all, you pay no premium for these special types.

Another heavy duty drill is NEW YORK's own Type 75 for deep drilling in 75ST aluminum. This high tempered, extremely abrasive metal can be a real headache — but not with NEW YORK drills. They bite in clean and easily, giving more holes, all perfectly round and on size.

Remember, NEW YORK *saves you 20% on your twist drill bill* and you get top quality work every time!

Write us now for catalog, technical manual and net prices.

NEW YORK TWIST DRILL COMPANY, INC.

EASTERN HEADQUARTERS:
278 Lafayette Street, New York 12, N. Y.
MIDWESTERN HEADQUARTERS:
30-A North Clinton Street, Chicago 6, Ill.

INDICATE A-3-246-1

Heat Treating

Economic features of completely mechanized heat treat lines explained in Bulletin SC-176; photos and diagrams illustrate steps to be used in building automated lines. Surface Combustion Corp., Toledo 1, Ohio. **L-3-14**

Metal Sawing

Revised 36-page edition of "Handbook of Metal Sawing" covers proper selection and use of hand and power hack saw blades and band saw blades; outlines recommended cutting speeds, feeds and techniques; discusses common metal cutting problems and their solutions. All items in the pocket size handbook are indexed for quick reference. W. O. Barnes Co., Inc., 1297 Terminal Ave., Detroit 14, Mich. **L-3-15**

Magnet Brake

Bulletin GEA-6214 offers eight pages describing outstanding features of the d-c magnet brake; explains simplified installation and maintenance procedures; drawing shows operating features; describes various applications; diagrams and tables show how it meets AISE standards. General Electric Co., Schenectady 5, N. Y. **L-3-16**

Casting with Epoxy Resins

Techniques involved in using epoxy resin compounds for casting described in technical Bulletin No. 10; covers general handling characteristics of epoxies for casting and special handling required with wood, plaster and plastic molds and with flexible molds; also treats aspects involved in curing cast epoxies. Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J. **L-3-17**

Die Sets, Accessories

A 56-page technical section and 20-page net price book on line of die sets and accessories have been printed separately but bound together in Catalog No. 11 so that they can be read simultaneously; includes information on how to select and use die springs, how to save on steel specials as well as specially-compiled load comparison tables for chrome-vanadium springs; a section is designed to simplify die set selection and ordering. The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. **L-3-18**

Drilling and Tapping

Series of catalog sheets describe air or hydraulic powered, electrically operated, automatic drilling and tapping units; well illustrated by drawings and diagrams. HyPneuMat Inc., 647 W. Virginia St., Milwaukee 4, Wis. **L-3-19**

NEW from CRAFTS

Versatile "lay away" clamped-on carbide circular form tool

Replacement costs and delays vanish with Crafts rugged, heat-treated alloy steel Tool Holder. Can be used over and over again for any number of different contours on B & S #00, #0, #2 machines.

Simply order our interchangeable carbide tips optically ground to your specifications. In stock for immediate delivery.

Diamond Dressers | Diamond Tools | Carbide Gages | Special Carbide Tools

Send Today for FREE CATALOG "Complete Carbide Tooling for Automation". Describes Crafts' newest time and money-saving contributions to the tooling field.

Arthur A. CRAFTS Company, Inc.
601 Newbury Street
Boston, Mass.

CRAFTS
Chicago
Detroit
Philadelphia
Bristol, Conn.

INDICATE A-3-246-2

Coil Inserts

Condensed performance data, design relationships, installation procedure and standard size data are incorporated in 4-page Bulletin No. 748, "Designing Your Product"; includes application drawings and installation photos; outlines both hand and power operation techniques used for installing inserts. Heli-Coil Corp., Danbury, Conn. **L-3-20**

Combustion Control

Information on complete line of automatic controls and instruments for combustion industry presented in informative brochure covering all equipment required for complete combustion installation. General Controls Co., 801 Allen Ave., Glendale 1, Calif. **L-3-21**

Abrasive Cutting Units

Line of abrasive cutting machines described and illustrated in 4-page Bulletin DH-460-B; lists specifications and outlines features and advantages. Campbell Machine Div., American Chain & Cable Co. Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **L-3-22**

Press Welder

Bulletin 3-513 describes and illustrates type EQB resistance press welders which meet welding requirements between RWMA standard sizes 3 and 4; points out important design features and discusses advantages to users. The Taylor-Winfield Corp., Warren, Ohio. **L-3-23**

Collets

Collets, pushers, feed fingers and pads for all types of screw machines as well as lathe collets are illustrated and described in Catalog 56; assembled for easy location of the items listed. Balas Collet Mfg. Co., Dept. C-4, Cleveland 14, Ohio. **L-3-24**

Carbon Brushes

Comprehensive 34-page Catalog No. 234-C describes 250 carbon brushes in company's line calculated to cover more than 2700 different applications; organized for ease of brush selection and identification; provides photo plus type and model numbers for each brush. The Ohio Carbon Co., Dept. 234, 12508 Berea Rd., Cleveland 11, Ohio. **L-3-25**

Drill Stops

Construction and advantages of line of drill stops with micrometer depth adjustment for drilling and reaming applications discussed in Bulletin 18-50; illustrated by diagrams and photographs. Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill. **L-3-26**

REED RTD

All the Foremost Spark Plugs

Have Threads

Rolled Exclusively on

REED MACHINES

COMPLETELY AUTOMATIC

Reed machines roll threads on the thin wall of spark plug shells with electrode already welded in place. Threads must be square with shoulder on part.

Rolled threads are superior. They are uniformly accurate, smooth and stronger—also more economical to produce.

Reed machines, used for both thread and form rolling, are made in 2 die horizontal and 3 die vertical and horizontal types for in-feed or thru-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Equipped for manual, semiautomatic or fully automatic feeding, Reed machines are suitable for both small job lots and large production runs.

Write for Thread and Form Rolling Bulletin

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

187

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-247

When shape and inaccessibility makes flat-surface machining of pump housings difficult...

Graymills Corp. cuts costs dramatically with an

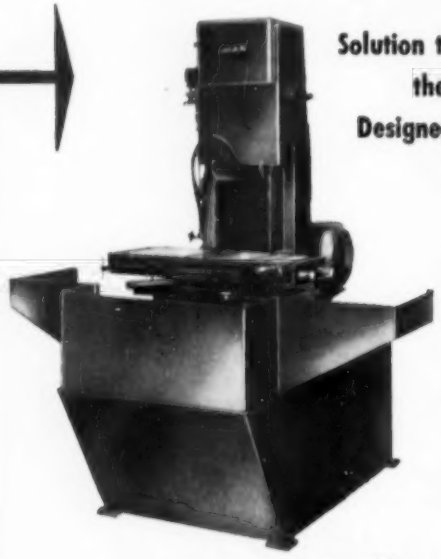
Engelberg Abrasive Belt Grinder

The shape of the intake-discharge housing on a Graymills immersion pump makes it unsuitable for surface milling or turning on a lathe. When either method is used, pump leakage results in as much as 10% of production runs, requiring corrective machining that pushes unit costs up.

Graymills installed an Engelberg platen type abrasive belt grinder, equipped with an automatic infeed table. To this machine (the BG8-FT9 described below) Graymills attached a draw-bar air fixture developed by their own engineers, designed to handle several sizes of castings with short run flexibility and minimum setup time.

Grinding rates on the grey metal pump castings are now considerably faster than alternative methods, in spite of a 1/32" stock removal. Very satisfactory belt life is obtained with 24-grit silicon carbide running at 5,000 s.f/m., cooled by a water-soluble chemical.

In the Graymills experience, Engelberg abrasive belt grinders again prove their adaptability to specific needs . . . adaptability that is limited only by the ingenuity of the engineers who program its use.



Solution to Graymills' Problem:
the BG8A-FT9
Designed for Mass Production

● Fast machining by wet or dry abrasive belt, backed by ground steel platen. Presetting controls rate of feed and pressure. Quick approach of ball-bearing table is followed by slower, hydraulically controlled infeed down to Micro-Stop limit. Does fine tool room jobs of surfacing, squaring, grinding angles, bevels, radii, etc.

For complete information on this and other Engelberg Abrasive Belt Grinders, write . . .

The ENGELBERG HULLER Co., Inc.
303 Seneca St., Syracuse, N. Y.

ENGELBERG
Precision ABRASIVE BELT GRINDERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-248

Threads

Well illustrated 16-page booklet, "Class 3A Threads," serves as primer on thread fit and gaging; gives basic principles of measuring high and low limits of pitch diameter tolerance, tips on gaging techniques, method for setting gages accurately, reference data such as pitch diameter tolerances, best wire sizes for 3-wire thread gaging and a double sampling plan of inspection. Standard Pressed Steel Co., Box 786, Jenkintown, Pa. **L-3-27**

Work Blades and Guides

Catalog No. G-678 gives comprehensive coverage of work blades and guides for Cincinnati grinding and lapping machines; specifications and drawing included for each type and model. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **L-3-28**

Alignment Testing

Illustrated 8-page pamphlet on "Alignment Testing" by K. J. Hume, author of the book *Engineering Metrology* and head of the National College of Instrument Technology in England, deals with measuring instruments generally, and discusses features of optical methods and their practical application, the auto-collimator and the block level. Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **L-3-29**

Steel Data

Revised 256-page edition of pocket-size data book gives information on machining and fabricating, specifications and tolerances, weights and dimensions, elements and safe loads; also includes tables, definitions and general data. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. **L-3-30**

Steel Castings

Summary of Steel Castings Specifications, prepared by specifications committee and technical staff of Steel Founders' Society of America, includes all specifications recommended for commercial, railroad, federal and military use as well as reference to testing methods advocated by the committee. Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, Ohio. **L-3-31**

Grit Blasting

Airless abrasive blast cleaning process for producing lustrous finishes on nonferrous metals discussed in brochure "Steel Grit Provides Bright-As-A-Penny Nonferrous Finishes." Includes case history material as well as photos of typical parts processed by the method. Wheelabrator Corp., 1182 S. Byrkit St., Mishawaka, Ind. **L-3-32**

technical Shorts

A POWER NOTE which suggests an important prediction to engineers who will be concerned about powering equipment is the Atomic Energy Commission's reported successful conclusion of a power demonstration by an atomic ship propulsion reactor. The reactor power plant was the land based prototype of the submarine Nautilus at the national reactor testing station in Idaho. Usion on a part of a single charge of uranium fuel, the nuclear reactor operated at an average power of 100 percent for more than 66 days and nights.

Power Hope From Atomic Fuel Tests

At the end of the 1600-hour test, the reactor still had many hundreds of hours of full operation available. It subsequently resumed operation at varying power levels to obtain engineering test data and to train the Navy personnel.

Among important benefits of the test was the obtaining of heretofore unavailable information on reactor performance during extended high power runs. Data gained will be used in design of improved nuclear propulsion plants both for naval vessels and civilian nuclear power plants.

* * *

SUCCESSFUL DEEP DRAWING of titanium alloys has been accomplished as a result of a major research project conducted for the past two years by Worcester Pressed Steel Co. for the U. S. Army Ordnance Corps, Watertown Arsenal. Importance of the development lies in the fact that titanium alloys can be fabricated by mass-production stamping methods. Prior to this development only pure titanium had been successfully deep drawn. Titanium alloys, because of their difficult working properties, were considered unsuitable for stamping.

Deep Drawing of Titanium Alloys Broadens Uses

According to Carter C. Higgins, president of Worcester Pressed Steel, his company was able to deep draw several different alloys in which titanium was combined with manganese, aluminum and tin, aluminum and vanadium, and manganese and aluminum. He indicated that all four of these alloys, if properly handled, can be drawn and heat treated for even higher strengths.

Aircraft manufacturers probably will realize the greatest benefits because of titanium's importance in production of jet aircraft parts which require high strength-low weight ratio, and high resistance to medium heats and corrosion.

* * *

IRON DUST finer than the smoke from a cigarette was used by General Electric researchers to create a potentially ten times stronger than presently available commercial magnets. According to Dr. T. O. Paine of G.E.'s Instrument Dept., speaking before the American Association for the Advancement of Science, the powder iron mag-

Experimenters Work to Make Stronger Magnets

SUBLAND TOOLS—
(Standard and Special)

Reduce SET-UP TIME, Cut PRODUCTION COSTS

To produce more work in less time and at reduced costs, modern production methods often require multi-diameter tools that perform a combination of operations with each pass—drill-counterbore, drill-ream, drill-chamfer, etc. Your best bet for accomplishing these objectives are subland cutting tools, precision produced by Detroit Reamer & Tool Company.

A leading participant in the original development of subland tools more than 25 years ago, Detroit Reamer & Tool Company has been a major manufacturer of such tools ever since. Thus, our engineering experience combined with modern manufacturing facilities assure that you receive the finest quality subland cutting tools.

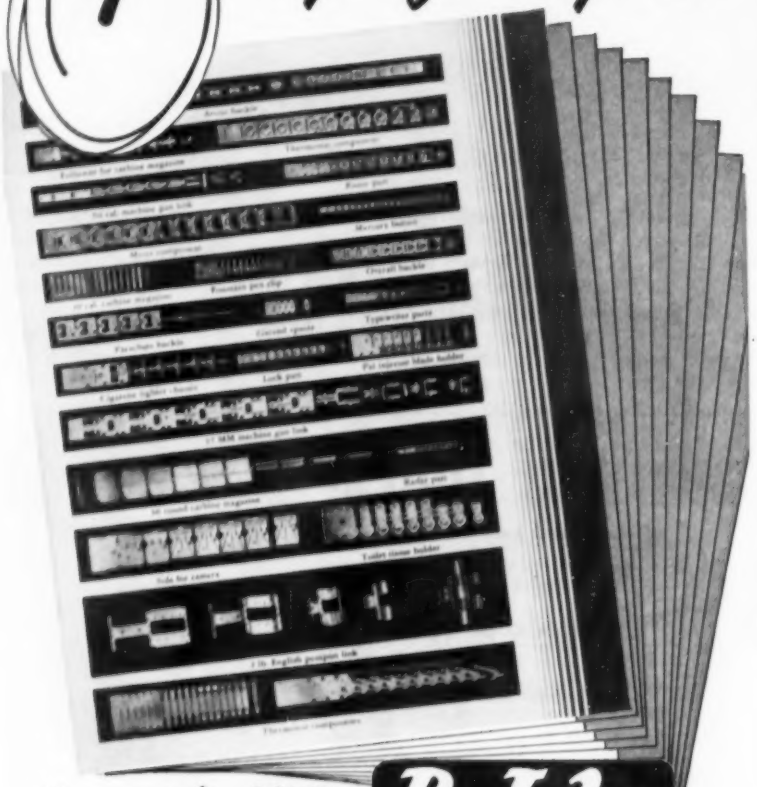
DR&T COMPANY

DETROIT REAMER & TOOL COMPANY

780 W. MAPLE RD. • P.O. BOX 174 • BIRMINGHAM, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-249

1 Page of Progress



from the NEW B. Jahn catalog!.....

Now available, the latest, revised edition of the B. Jahn Catalog. Scores of case histories show B. Jahn progressive die engineering and ingenuity solving mass production problems for America's most progressive manufacturers.

SEE how dies by B. Jahn end worry, wonder, waste! How B. Jahn can cure assembly headaches! How B. Jahn "Production Proved" Dies are built stronger, produce longer! How B. Jahn eliminated thousands of costly, unnecessary production operations and cut product costs! And more ! ! !

Send today for your copy of the NEW 20 page B. Jahn Catalog and learn for yourself how many of the world's largest manufacturers cut costs, improve product quality.

B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-250

net's properties are achieved by precisely controlling size and shape of individual iron particles so small that there are more than a billion billion in one pound.

Although it will be some time before such magnets are commercially available, they suggest the possibility of new electric instruments that are smaller, lighter and more accurate for the future.

The iron particles can be embedded in plastics, metal, rubber or glass. The magnets can be easily machined, drilled, tapped, soldered or molded precisely into any shape.

Another practical aspect of the research findings is that ordinary iron is used which means the saving of strategic metals such as nickel and cobalt which are heavily used in making most magnets. Absence of cobalt, too, makes possible the application of magnets in nuclear reactors where magnets containing cobalt can not be used because of high induced radio activity.

Although the iron particles are so small they are invisible under a conventional microscope, magnetic and mechanical properties of the created material can be controlled precisely.

* * *

Informative Films from Industry

THREE INDUSTRIAL films have recently been made available for companies or organizations which might make practical use of them for industrial training purposes or to keep engineering or executive personnel up to date. One film deals with machine bending technique, a second with motor maintenance, and a third with machine tool duplicating equipment.

Up-to-date developments and productions are treated in this 16 mm color sound movie on machine bending techniques by Pines Engineering Co. Inc. The 40-minute film is a documentary story showing both standard and special tooling applications in 36 different locations. On-the-job studies range from work in modest job shops to large multiplant organizations. Tooling techniques and various cold bending operations are shown under actual job conditions. Comparative production information is supplied on each job. Requests for showing are made on company letterhead to the Pines office in Aurora, Ill.

Two 20-minute, 35 mm color sound slide films to show maintenance people how to install and properly maintain electric motors are made available by Allis-Chalmers Mfg. Co. The films, "How to Make a Motor Go-and Go, and Go, and Go," covering maintenance,

CHILE	COLOMBIA	PERU	ARGENTINA
SPAIN	PORTUGAL	SO. AFRICA	SWEDEN
ISRAEL	JAPAN	BELGIUM	MEXICO
INDIA	AUSTRIA	BRAZIL	CANADA
ITALY	GERMANY	URUGUAY	ENGLAND
DENMARK	FINLAND	FRANCE	U.S.A.

24 NATIONS UNITED...

on Choice of Yoder Mills for Pipe and Tube Manufacture

It all started less than two decades ago with the introduction by Yoder—and the rapid adoption by American industry—of a revolutionary new type of mills for cold forming and electric-resistance welding of pipe and tubing. England, France, Italy, Mexico, Argentina, and Brazil soon followed the U.S.A. in adopting these mills. Other countries boasting any kind of modern metal working industry did likewise, even including distant Japan, India and South Africa. Production, depending on requirements, varies from 25,000 up to 75,000 feet per 8-hour shift.

●

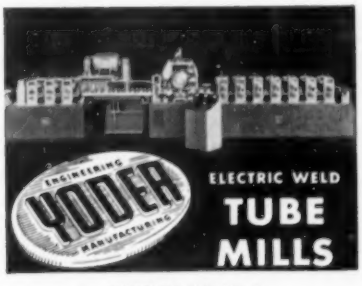
By this time, England, Italy and Argentina each have a total of ten Yoder mills in operation; Brazil, eight; Mexico, six; France, five; other nations somewhat in proportion to their population. In many nations, Yoder mills now supply from 50% to 90% of all welded tubes used. Several oustanding production records have been scored by operators in foreign countries, most recently in Italy. Reasons: the simplicity of design, ease of operation and dependability of Yoder mills. Secondly, generous assistance rendered by Yoder in training operators everywhere.

●

Through technological advances, Yoder leadership in tube mill design has been jealously maintained and strengthened from year to year. Ask for literature giving details of the latest improvements. Correspondence invited.

THE YODER COMPANY

5325 Walworth Ave. • Cleveland 2, Ohio, U.S.A.



INDICATE A-3-251-1

and "How to Take Step Seven," dealing with proper installation illustrate steps by cartoon characters. Viewings can be arranged through the company's Industries Group sales offices.

The Rockford Machine Tool Co. has released a 36-minute, 16 mm sound color film called "The Rockford Kopy-Kat" to show design and operation of this hydraulic duplicator attachment. Uses animated diagrams for illustration. Reservations for the film are made through area factory representatives or the company office in Rockford.

* * *

Develop Stronger Casting Alloy

PRODUCTION of intricate, completely-formed aircraft and missile parts in a single operation appears to be considerably simplified as a result of development of a new aluminum casting alloy. According to the Los Angeles Div. of North American Aviation, Inc., who developed it, the alloy is so strong that a square inch of it can lift ten automobiles. So far, the alloy seems to offer cost economy, considerable extra strength, and savings in production time over that formerly required to make a part.

Already the material, called 42B, is being used for jet plane and missile parts, while other uses are being explored. It also appears possible that its use may result in various forgings being replaced by castings of 42B in aircraft and other industries.

* * *

New Zinc-Clad Alloy Simplifies Soldering Job

MANY PROBLEMS associated with smooth and economical soldering of heat-exchanger equipment may be beaten with the introduction of a zinc-clad aluminum alloy made by Aluminum Co. of America. After several years of research and development, the fabricators have come out with a material designated Alcoa soldering sheet which they hope brings aluminum within range of the ease of solderability heretofore enjoyed by copper.

The sheet is fabricated with one or both sides clad, and in coil or flat sheet form. In industrial use, it is expected to help solve various joining problems, particularly in the auto radiator field.

Used with specially developed Alcoa soldering techniques, zinc-clad aluminum probably will simplify normal maintenance and repair problems of soldered assemblies, and is likely to reduce costs of production methods.

Magna-Lock

Magnetic Chucks and Devices

Magnetic Chucks

Rectangular

From 5" x 10"
To 30" x 96"

Rotary

From 6¼" dia. face
To 72" dia.

Swiveling

From 5" x 10"
To 12" x 84"

Sine Chucks

For speed and accuracy in setting up for angular grinding working surface:

6" x 11½"
6" x 20"

Magna-Vise

For holding non-magnetic materials on magnetic chucks. Available in 6", 10" and 14" lengths.

Chuck Accessories

Demagnetizing units, voltage regulator, rectifiers.

Take advantage of Magna-Lock's experience and engineering "Know-How" to help you solve your chucking problems.

Magna-Lock also offers a complete chuck repair service on any type and make of electrical magnetic chuck.

SEE OUR EXHIBIT AT WESTERN METAL SHOW LOS ANGELES MAR. 25-29 Booth No. 1040

Magnetic Chucks

ASTE DATA SHEETS

Hanchett Magna-Lock Corp.

Magna-Lock Inc.
Magnetic Chucks and Devices
Big Rapids, Michigan, U.S.A.

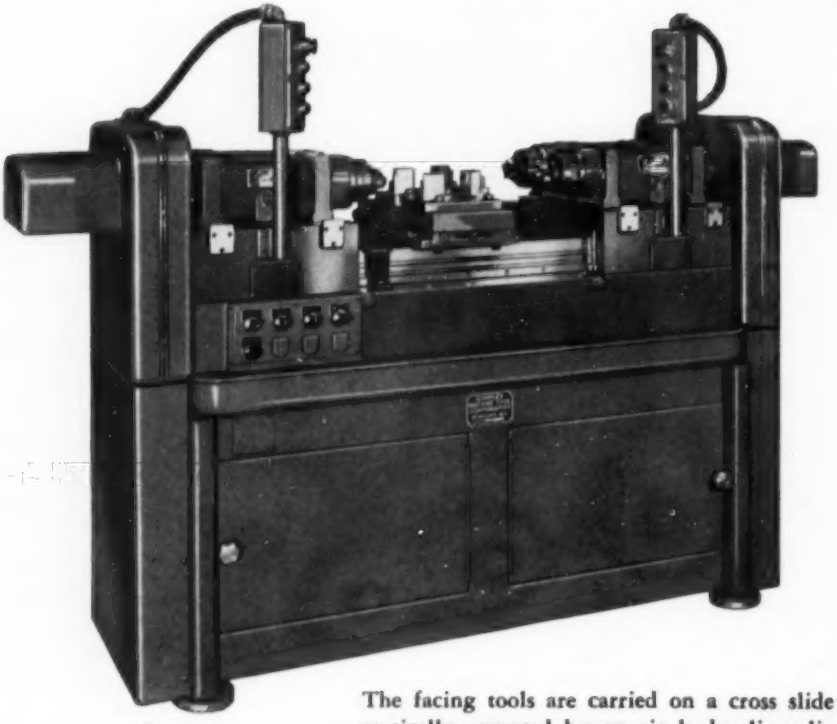
INDICATE A-3-251-2

25TH YEAR
1932–1957

Simplex

BUILDING PRECISION BORING MACHINES

SIMPLEX 2BDA double end, bridge type, mechanical automatic cycling unit for facing one side of an automobile pump rotor. The operation performed consists of facing one side square with the pitch line of the internal gear. The side faced is used as a locator for subsequent surface grinding operations.



The facing tools are carried on a cross slide which is automatically operated by an air hydraulic cylinder. This cross slide is mounted on the standard machine table which shuttles longitudinally to provide loading clearance.

SIMPLEX MACHINE TOOL CORPORATION
4528 WEST MITCHELL STREET
MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

FIELD notes

Industrial Activity in Nuclear Fields Shows Marked Progress

Progress report from the Atomic Industrial Forum shows that during 1956 the U. S. atomic industry began construction or received contracts for the building of 59 new nuclear reactors. Of these units, 30 are research and test reactors for private U. S. buyers, for the federal government and for overseas export. The remaining 29 units are power type reactors designed for naval and merchant ship propulsion, for prototype or demonstration reactors for AEC and for land based power demonstration plants for private buyers.

Total of industrial users of radioactive isotopes in this country is now 1121 firms in more than 1500 geographic locations. More than 20 companies completed or planned to build major radiation research centers.

Industrial interest is taking varied channels. During the past year, eight companies signed contracts calling for construction of uranium ore processing mills. Another firm plans to build a feed materials production plant. Others announced arrangements to construct nuclear fuel element manufacturing plants while three more are creating zirconium production plants and two are building beryllium production facilities.

Activities are from a variety of firms, including chemical, paper and plastics, research, development and testing, manufacturers of electrical equipment, electronics and instrumentation, and metalworking firms.

new ventures

The Datics Corp. in Fort Worth, Texas is now staffed and equipped to provide commerce and industry with large scale scientific computing, industrial and commercial data processing, scientific and engineering data reduction and experienced consultation on a contract basis. When such aims cannot be carried out on commercially available equipment, specialized equipment is developed for the job.

v v v

A clearing house which arranges contacts between manufacturers in the United States and abroad has been established by the International Patent Exchange, Elmhurst, Ill. The service is designed to curb difficulties encountered in checking licensing or partnership arrangements.

v v v

Publication of monthly digests and digest translations of current articles on production, design, development and research from journals throughout the world has been instituted by The Technical Digest Service, Inc. of New York. Material considered of prime industrial importance is condensed and evaluated under the general editorship of Prof. E. S. Machlin of Columbia University and with the aid of an advisory board of editors.

v v v

During the early summer Electronic Associates, Inc. will open an analog computation center in Brussels, Belgium. The center will provide the latest types of electronic analog computers and will be staffed by scientists for problem analysis and programming. Equipment and staff of the center will be available for rental on an hourly, weekly or monthly basis to companies in Western Europe.

Problems in management operations control, dynamic systems analysis and applications engineering also will come under the center's interest. As each problem is submitted, the center will assign necessary scientists, engineers or mathematicians to evaluate, set up and solve it.

v v v

Wagner Brothers, Inc. has entered the plating chemical processing field to round out its established line of automatic plating machines, rectifiers tanks, anodes and related equipment and supplies. A new Lyndon Ave. chemical processing plant, separated from the company's other plants, already is in production. All chemical operations are under the direction of Bruno Leonelli, vice-president-research.

v v v

Consulting, engineering and sales service in connection with contact meter relays and associated control components is being offered to New England manufacturers by Assembly Products, Inc. in Chesterland, Ohio.

research

Plans for a large research and development center at Pompano Beach, Fla. are being formalized by U. S. Industries, Inc. The USI Technical Center, Inc., a subsidiary of U. S. Industries, will be concerned with research and development work for the company's 12 diversified divisions. According to schedule, the company will move into the first completed units by the third quarter of 1957.

v v v

Establishment of an advanced semiconductor laboratory to bridge the gap between basic research and semiconductor product engineering has been announced by General Electric Co. The laboratory, located in Electronics Park in Syracuse, N. Y. will take over and expand activities in semiconductor research previously performed by the company's Electronics laboratory.

new facilities

New building to house research and engineering facilities for the five affiliated Molded Fiber Glass Companies has been completed at 4826 Benefit Ave., Ashtabula, Ohio. Built for the Molded Fiber Glass Research Co., which is jointly owned and supported by all five Molded Fiber Glass Companies, the structure is designed as a centralized laboratory for research and testing work on raw materials, processes and finished products in the field of fiberglass reinforced polyester resin. Experimental and development work in other reinforcements and resins also will be done in the new laboratory, as well as equipment and process engineering.

v v v

A Canadian manufacturing and service plant, Sheffield Tool and Gage of Canada, Ltd., has been established in Windsor, Ontario, by The Sheffield Corp. While the new Windsor affiliate will handle all Canadian repair and

service order, Sheffield new product sales will continue to be handled through the company's Canadian sales representatives, A. C. Wickman, Ltd.

v v v

A 140,000-sq ft plant in Dayton, Ohio, formerly owned by Standard-Thompson Co., has been leased by American Machine & Foundry Co.'s Leland Electric Co. Div. to consolidate production facilities for Leland's aircraft products. The plant is on a 29-acre site and AMF has purchased an additional 55 acres of land contiguous to the plant site property to allow expansion. The new plant will permit Leland to combine its aircraft products engineering and aircraft inverter and alternator manufacturing operations in one facility from the three Dayton locations in which they are now operating.

v v v

A $5-million plant is being built by Standard Pressed Steel Co. in Santa Ana, Calif. to provide a functional, multiproduct manufacturing facility capable of switching efficiently from one product to another. When completed, early in 1958, the 280,000-sq ft facility will employ approximately 500 persons, and will provide considerably faster service to the company's West Coast customers.

v v v

The Bristol Co. has opened a new branch factory and warehouse in Houston, Texas.

v v v

A new Eastern carbide metals shop geared to process small quantities of specially-shaped cemented carbide tools has been completed by General Electric's Metallurgical Products Dept. The new plant, located in Kenilworth, N. J. covers about 5,000 sq ft. It will service the Eastern half of the country.

v v v

West coast plant of Avildsen Tools and Machines, Inc. has been opened in Glendora, Calif. Operations will be transfered from the original location at 1320 Santa Fe Ave., Los Angeles. The new factory, which is known as Plant No. 3 in the ATM organization, is valued in excess of $1-million including equipment and inventory.

heinrich GripMaster
VISES
with exclusive "CIRCLE-GRIP" LOCKING MECHANISM
The fastest—safest—most accurate line of screwless type holding devices ever offered to industry.
GripMaster jig and fixture base
JUST ADD BUSHING, FALSE JAWS & BACK PLATE
TO DRILL HOLE IN SPROCKET ARM
The Grip Master drill jig, shown in the above illustration, cost a Heinrich customer $60.00. Original drill jig design was estimated at $250.00. This is just one example of how you too can cut tooling costs with the Heinrich jig and fixture formula.
Sets and Locks in a flash!
Speedy loading and unloading cuts production costs.
4 GREAT GRIP-MASTER WORK SAVERS
Heinrich Grip-Master Fixture lock on multiple drill jig.
The Grip-Master Fixture locks make jig and fixture designing easier—does away with locking details and troublesome clamps.
Tool steel cuts faster, safer when locked in the grip of a Heinrich band saw vise. Unlike other Heinrich Vises guide bar is of soft cold roll steel to prevent damage to saw blade—shoulder screws are removable for chain feed.
Heinrich Band Saw Vise leaves hands clear of saw for safe operation.
Heinrich Safety Drill Vise, with built-in recessed parallels, holds work square. Vertical V-groove provides positive grip on rounds—table mounting attachment does away with clamps, straps, and adapters. Vise cannot swing off table.
Heinrich Safety Drill Vise increases production with accuracy.
Write for free catalog—learn how Heinrich Grip-Masters can cut tooling costs.
HEINRICH TOOLS, INC., Dept. 187C, Racine, Wisconsin
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-254

expansions

Standard Die Set Manufacturers, Inc. of Cranston, R. I. has just invested more than $100,000 in new capital equipment. Major share of the investment was for installation of an automatically controlled heat treating unit which automatically carburizes, hardens and quenches a wide variety of steels under a protective atmosphere blanket.

v v v

Arrow Tool Co., Inc. has doubled the size of its Wethersfield, Conn. plant. The company also has formed a production subsidiary, Mech-tron Instrument Corp. which will produce precision electro-mechanical components and assemblies for the electronics and business machine industries.

v v v

A modern $2-million manufacturing plant which more than doubles size and output of the installation it replaces, has been opened by Bridgeport Thermostat Div. of Robertshaw-Fulton Controls Co. The new 180,000 sq-ft structure is located near Boston Post Rd, Merritt Parkway and the New England Throughway now under construction.

v v v

A multi-million dollar expansion program has been completed at Dana Corp.'s Parish Pressed Steel Div. to bring a 40 percent increase to its automotive frame production. The expansion involved construction of two additional bays, one 560 ft long by 90 ft wide, and the other 820 ft long by 90 ft wide.

Housed in the larger bay are complete production lines for manufacturing Buick Model 40 and Mercury chassis frames.

V V V

A three-year expansion and construction program has been completed by Crane Packing Co. to make its manufacturing and service facilities immediately available to important industrial areas throughout the United States and Canada. Construction encompassed erection of four new plants and expansion on a fifth. These included a plant in Houston, Texas, home facilities in the Chicago area, Los Angeles plant, one in Hackensack, N. J. and considerably expanded offices and factory at Hamilton, Ontario.

V V V

As a means toward long term expansion, The Carpenter Steel Co. has acquired an additional 60 acres of land adjoining its mill in Reading, Pa. This acquisition increases the company's total area owned or controlled by 50 percent and assures its ability to meet major expansion requirements.

V V V

Clark Controllers, Ltd., a subsidiary of Clark Controller Co. has opened a new 70,000 sq ft plant in Scarborough, Ontario, a part of Toronto. The plant represents a 50-percent increase in floor area over previously-occupied facilities.

V V V

A half-million dollar plant addition to The Taylor-Winfield Corp. facilities has been completed. New construction involves two adjacent buildings with a total manufacturing space of about 30,000 sq ft, or an increase of floor space of 35 percent. This is the firm's seventh major expansion since 1945.

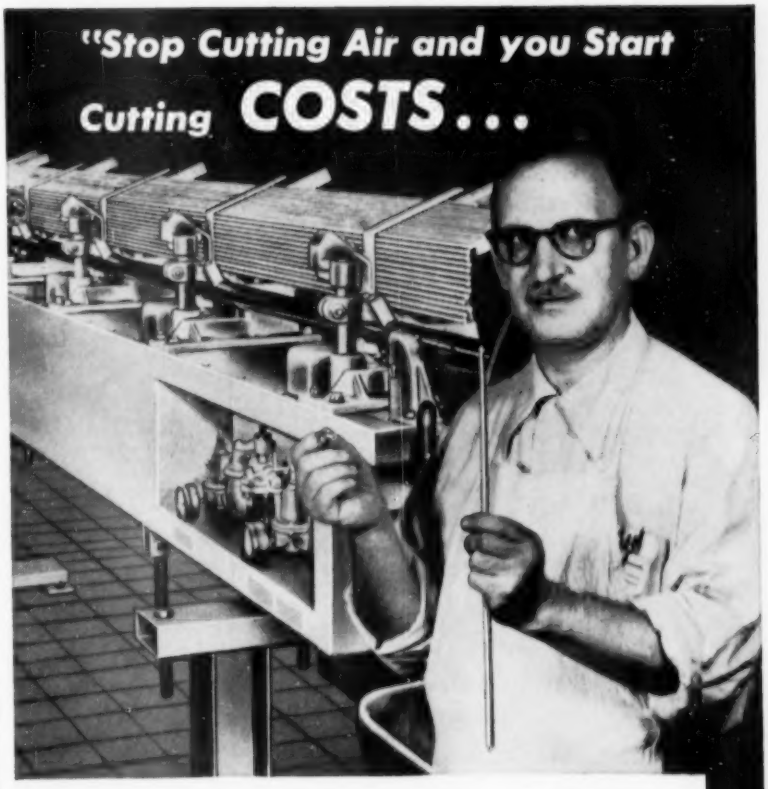
moves

A $2,300,000 cylinder plant is being built in Bensenville, near Chicago, to house the Flick-Reedy Corp. which presently is located in Melrose Park, Ill. The move will give the firm five times more space and enable it to increase its productive capacity by about 70 percent immediately.

Main feature of the new plant is its heat pump designed to compress outside winter air to keep interior temperature at 70 deg even when it is 10 below outside. It can be reversed in summer to air condition the office and factory.

V V V

Temco Aircraft Corp. is planning for a new 100,000 sq ft office building to be built at its Garland, Texas plant. It is scheduled for completion this summer. Corporate offices, including some administrative and supporting functions, will then be moved from the company's



Just equip with

LIPE Automatic
MAGAZINE LOADING BAR FEED"

Says Foreman Billy Smathers*

"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small ⅜" piece, and 108% faster for the 16" piece. That opened our eyes . . . but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock . . . so many units of output per so many units of time. Overall, the gain was astonishing!"

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

* Photographer's models and pseudonyms used to protect company identity and confidential information.

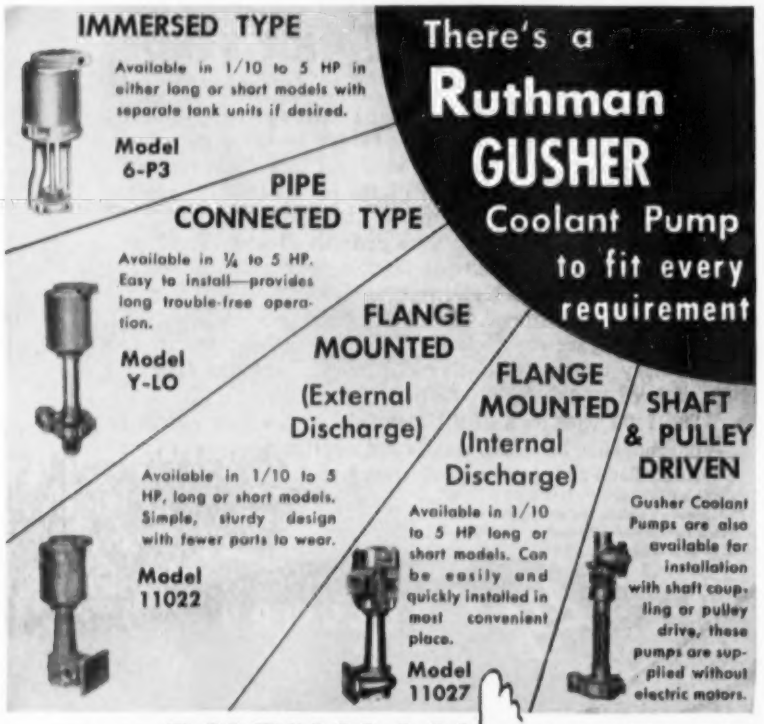
LIPE ROLLWAY
Lipe-ROLLWAY
CORPORATION
SYRACUSE 1, N. Y.

Machine Tools • Heavy-Duty Automotive Clutches • Portable Power Hack Saws

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-255

ETALON
INGAGE
measures the exact BORE or blind hole size!
Reading: .0001"
Size: 3/16" to 1.6"
Takes accurate measurements of blind holes. No masters or setting rings—measures directly—by .0001"
Automatic alignment, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes; with extensions measures holes up to 6 feet deep. Hardened contact points exert minimum pressure—will not damage fragile work.
Easy to read, deep graduations on a large diameter thimble. Dull chrome plated. Furnished in English or Metric graduations, individually or in sets.
WRITE FOR CATALOG on complete line of precision measuring instruments: VERNIER CALIPERS, MICROMETERS, DIAL INDICATORS.
ALINA
ALINA CORPORATION
122 East Second St.
Mineola, L. I., N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-256-1


There's a
Ruthman
GUSHER
Coolant Pump
to fit every
requirement
IMMERSED TYPE
Available in 1/10 to 5 HP in either long or short models with separate tank units if desired.
Model 6-P3
PIPE CONNECTED TYPE
Available in ¼ to 5 HP. Easy to install—provides long trouble-free operation.
Model Y-LO
FLANGE MOUNTED (External Discharge)
Available in 1/10 to 5 HP, long or short models. Simple, sturdy design with fewer parts to wear.
Model 11022
FLANGE MOUNTED (Internal Discharge)
Available in 1/10 to 5 HP long or short models. Can be easily and quickly installed in most convenient place.
Model 11027
SHAFT & PULLEY DRIVEN
Gusher Coolant Pumps are also available for installation with shaft coupling or pulley drive, these pumps are supplied without electric motors.
THE RUTHMAN MACHINERY CO.
WRITE FOR CATALOG
1810 Reading Road
Cincinnati, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-256-2

Grand Prairie Plant to Garland.

Already under construction for Temco is the engineering research and development center at the Garland plant. A large portion of the engineering department will be transferred to the new center in July.

V V V

After 42 years at the Lafayette St. location, Chase Brass & Copper Co. has moved its office and warehouse business to its new building at 55-60 Fifty-eighth St., Maspeth, Long Island, N. Y.

corporate changes

E. W. Bliss Co. has acquired 20 percent interest in Chemetals Corp., a research and development organization primarily concerned with production of copper powder by chemical methods and fabrication of copper strip, tubing and other wrought shapes directly from copper powder.

V V V

The Cleveland Automatic Machine Co. has merged with The J. H. Day Co., Inc. Name of the continuing organization is The Cleveland Automatic Machine, while Day operations will be carried on as the J. H. Day Co. Div. Merger of the two firms is part of the expansion and diversification program of The R. K. LeBlond Machine Tool Co. which owns Cleveland Automatic.

V V V

Officers of Vulcan Tool Co. and of Steel Products Engineering Div. of Kelsey-Hayes Co. have made public the purchase by Vulcan of Steel Products' Brehm Die Div. C. Palmer Meredity, president of Steel Products stated his company is relinquishing all rights and assets involved to Vulcan because of future commitments along other lines.

V V V

Wire and cable business of the United States Rubber Co. was purchased by Kaiser Aluminum & Chemical Corp. effective February 1. The transaction included U. S. Rubber's plant at Bristol, R. I. and its wire and cable inventories. In addition, Kaiser Aluminum took over U. S. Rubber's nationwide wire and cable sales organization and network of distributors as well as all Bristol plant personnel. Service is expected to continue without interruption.

V V V

Recent announcement revealed acquisition of The Beta Corp. by Robertshaw Fulton Controls Co. Beta Corp.'s operation will be moved from Richmond, Va., to Philadelphia and consolidated with the Fielden Instrument Div., a unit of Robertshaw-Fulton.

At the same time Robertshaw-Fulton

made public the agreement whereby it would acquire all assets and business of Acro Manufacturing Co. of Columbus, Ohio. According to present plan, Acro will become a division of the purchasing company and its operations will be continued with its present management and staff.

v v v

Controlling interest in the Chicago steel fabricating firm of Coburn Engineering Co., Inc. has been purchased by two of its officers. Robert Pyle, president, and Richard Cunningham, vice-president and secretary, acquired the interests of seven other stockholders.

v v v

National Electronics Laboratories, Inc. has been acquired by Thiokol Chemical Corp. according to a joint announcement made recently. National Electronics will operate as a wholly-owned subsidiary under its present name. At present no change in company management is expected.

altered operation

In a decentralization move, the Edmore, Mich., plant of General Electric Co.'s Metallurgical Products Dept. has been made the Magnetic Materials Section of the department. It will have full responsibility for manufacture and marketing of permanent magnets and specialty resistors.

v v v

Operations of Minneapolis-Honeywell's Doelcam and Transistor Divs. in Boston have been consolidated into a single unit which will be known as the Boston Div. According to the company's announcement, the organizational realignment was designed to increase efficiency by eliminating duplication of services and functions performed independently by the two previous divisions. The new division is composed of two sections: a semiconductor product section for power type transistors, and an instrument section for synchro motors, gyroscopic instruments, electronic control and test equipment.

service changes

Latrobe Steel Co. has announced completion of an initial warehouse stocking program for its prehardened die casting die steel, Viscount 44.

v v v

Three new lines, covering hand and power hack saw blades, metal cutting band saws and flat ground die steel, have been added to the line of files made by Heller Tool Co. The lines were introduced as a result of development of a steel treating process called job

ACCO products

Wilson "Tukon" Micro Hardness Testers

UNEXCELLED for testing fine parts... METALLIC and NON-METALLIC

Model LR
Floor model for Micro and Macro Hardness Testing.

WILSON "TUKON" Micro Hardness Testers meet every fine test requirement. These precision instruments are invaluable in the proper testing of fine precision parts, fine wire, thin metal, shallow superficially hardened surfaces, jewels, plastics, glass, etc. WILSON "TUKON" testers operate with both Knoop and 136 degree Diamond Pyramid Indenters.

Model FB
Floor model for Micro Hardness Testing only. (Electrically operated)

Consult with WILSON Engineers on your hardness testing problem

Experienced WILSON Engineers will be glad to help you select the proper model for your particular requirement. This choice depends on the type and thickness of work to be tested, range of loads and other hardness testing equipment available.

Model MO
Table model for Micro Hardness Testing only. (Mechanically operated. Also available in floor model)

Write for Booklet **DH-328** *on* WILSON "TUKON" *Micro Hardness Testers. Ask for* **DH-325** *on* WILSON "ROCKWELL" *Hardness Testers.*

WILSON "ROCKWELL"...
the world's standard of hardness accuracy

ACCO
Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE
270-H Park Avenue, New York 17, N. Y.

for Better Values

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-257

If your product requires threaded fasteners...

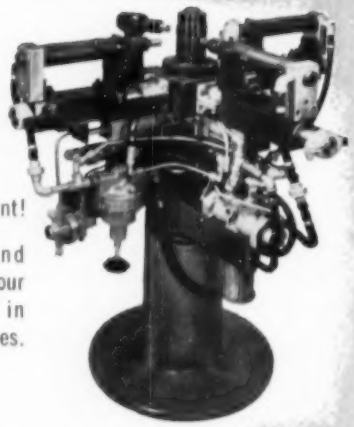
Ingersoll-Rand

ASSEMBLY MACHINES

can help you save time, money and improve product quality

- any size bolt or screw!
- hand held or automatic!
- maintains desired torque!
- as many spindles as you want!

Contact an Ingersoll-Rand AIRengineer now . . . he's your link with a world leader in automatic assembly machines.



8-521

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-258

tempering—an application of recent developments in tool metallurgy combined with special heat treating processes. The tools will be available through authorized distributors.

v v v

Precision Castings Co., division of Harsco Corp., has spent more than $1½-million to complete a series of highly integrated, automatic finishing departments to augment its facilities. Included are automatic equipment for cleaning, copper-nickel and chrome or brass plating, phosphate coating, electrostatic spray painting, baking and polishing.

v v v

Quick delivery as well as normal order handling are facilitated by the off-the-shelf program initiated by Link-Belt Co. for its roller shear pin sprockets.

v v v

Announcement has been made by Walter W. Field and Son that they are again scheduling the manufacture of Hart Divided machine vise jaws.

v v v

Branch office for Carl Hirschmann Co. has been established at 5122 Dundas St. W., Toronto, Ontario, Canada, to provide sales and service on Hirschmann equipment in Canada.

sales

Alfred J. Chandler is new sales manager for Brush Div. of The Osborn Mfg. Co. Associated with the organization since 1945, he has been manager of industrial sales. He is a member of ASTE's Cleveland chapter.

v v v

Robert G. Dee was made general sales manager of the ElectroData Div. of Burroughs Corp. He previously was central regional manager for the division.

v v v

New Process Gear Corp. has announced appointment of Robert W. Wolfe as general sales manager. He formerly was chief engineer, a post now filled by the appointment of Thurman O. Ruettinger. Mr. Ruettinger has been assistant chief engineer.

v v v

Tom W. Smith was named general field sales manager of Champion Screw Co. He has been associated with the threaded fastener field for the past 15 years.

v v v

Appointment of Gordon C. Curry as general sales manager has been made public by Precision Castings Co., a division of the Harsco Corp. He has been eastern sales manager since 1949.

THEORIE ET PRATIQUE DES OUTILS DE COUPE—*by Edouard Blanapain, published by Eyrolles, Boul. Saint-Germain, Paris, France. 642 pages. Printed in French.*

This book on the theory and practice of cutting tools is basic in its approach. It is written simply and directly so it can be translated without difficulty and it gives the European viewpoint, which is well worth considering. Tool geometry, materials, types of tools, chip breakers and cutting fluids are some of the important topics discussed at length. Tool grinding and maintenance are also considered. This book would be of particular interest to anyone doing cutting tool research, cutting tool design or tool maintenance.

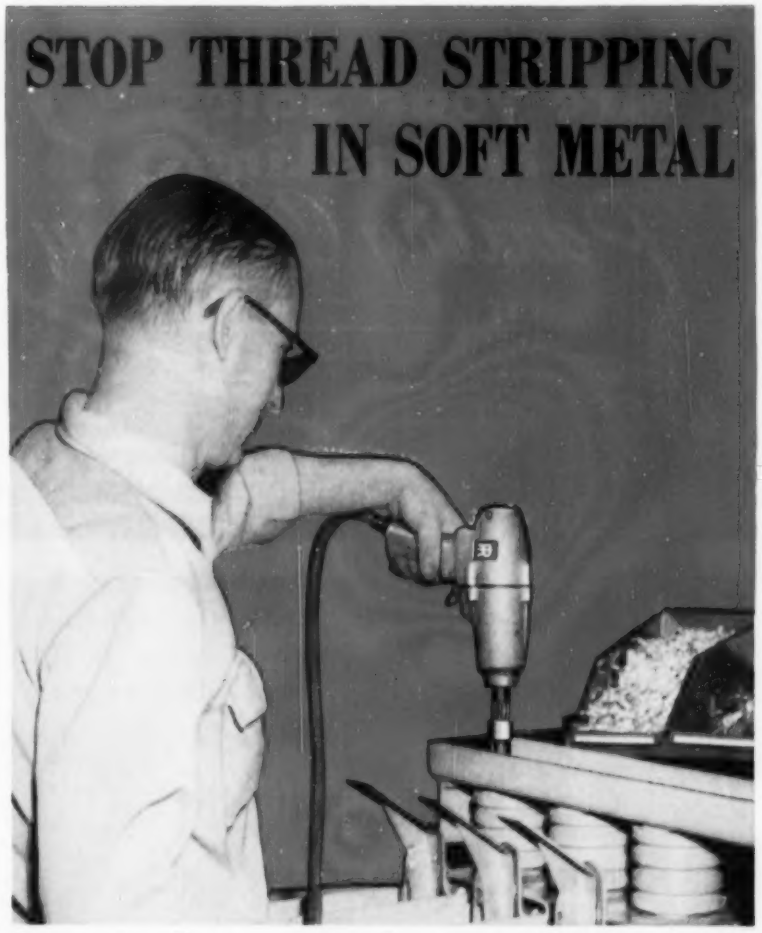
Considerable background information is included also on the development of tools for the various metal-cutting operations.

MODERN PHYSICS—A TEXTBOOK FOR ENGINEERS—*by Robert L. Sproull. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. 503 pages.*

The aim of this book is to present to engineers those parts of physics which are of greatest importance in engineering, highlighting the modern physics of electrons, atoms and nuclei. Also discussed are the applications to the electrical, thermal, mechanical and magnetic properties of solids and to the electrical and chemical properties of surfaces.

Organized for either self-study or for a formal program, the book features a large number of problems with a wide range of difficulty. It also offers a good selection of references at the end of each chapter.

This book brings to the engineer a



here's how it's being done with
Ingersoll-Rand
TORQUE CONTROL
impactools!

If you assemble soft metal threaded parts, such as aluminum or bronze, take a look at the improvement record made by this large electrical manufacturing company.

Parts spoilage is substantially reduced and product quality greatly improved since changing from conventional air powered wrenches to new Ingersoll-Rand Torque Control Impactools for running nuts and cap screws. These revolutionary Impactools shut off instantly and automatically when the preset torque is reached. No more stripped threads . . . and every fastener is precisely tightened for top quality.

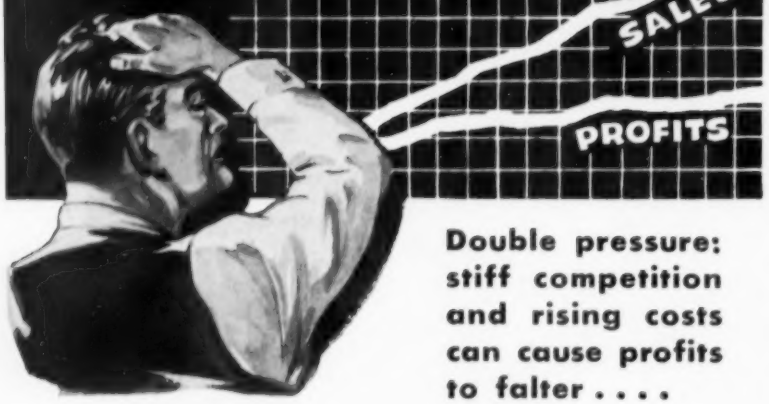
Call or write for bulletin 5170, or ask for an obligation-free demonstration.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

8-523

FOR MORE INFORMATION, USE READER SERVICE CARD; INDICATE A-3-259

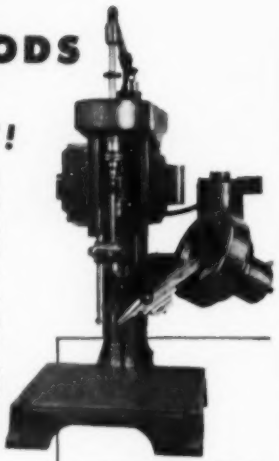
Are your Sales and Profits Lines ? *Parting Company*



Double pressure: stiff competition and rising costs can cause profits to falter . . . .

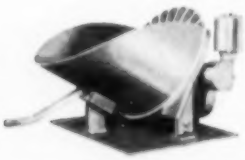
DPS POWER ASSEMBLING METHODS will help sustain *THAT PROFITS LINE!*

• Though profits may continue to move upward under present conditions, profit increases may not match sales advances. Here is where DPS methods with their time-saving, stepped-up output and lower costs can meet the situation effectively. Results in progressive plants everywhere prove it. Plan now to put more profit into your feeding and assembling operations. DPS POWER SCREWDRIVERS and SELECTIVE PARTS FEEDERS will do it. Write us, give details. We'll send catalog and recommendations.



SCREWDRIVING MACHINES
Bench and Pedestal Types
5 Models

BOWL FEEDER
Electrical vibratory type to feed parts that cannot be tumbled.



BARREL FEEDER
with stationary ring cover for heavy-duty production.

BARREL FEEDER
Popular motorized type, for parts requiring critical selection.

DETROIT POWER SCREWDRIVER CO.

2799-A W. FORT ST. DETROIT 16, MICHIGAN

FOR MORE INFORMATION, USE READER SERVICE CARD; INDICATE A-3-260

fund of knowledge necessary to the full understanding of many modern engineering processes and developments.

MODERN PHYSICS FOR THE ENGINEER—*Edited by Louis N. Rtdenour. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.50. 490 pages.*

The time lag between scientific discovery and engineering application has been drastically shortened in recent years, so that it is more than ever necessary for the engineer to be aware of the significant developments in the fields of the physical sciences.

To this end, a series of lectures was given at the University of California and these were so well received that it was decided to put them into print for the benefit of the technical man.

The three broadly defined sections of the book cover the laws of nature, the world we live in, and the communication of information. Especially interesting for the engineer is the discussion of nuclear structure and transformation and nuclear power.

The book broadens your viewpoint on your particular branch of engineering by showing you the fundamental physical laws on which all engineering is ultimately based.

HUMAN RELATIONS IN SMALL INDUSTRY—*by John Perry. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $5.50. 330 pages.*

The purpose of this book is to help the head of a small business understand and meet some of the human relation problems that arise in the everyday affairs of industry. It couldn't have been written twenty-five years ago, although there were some who knew the principles. As these few men weren't able to convince others to follow their practices, the problems of human relations were slow in being recognized and therefore solutions came only upon experiences. Today there is a backlog of experience. The book covers human relations from executives to production-line workers, explaining group as well as single or individual attitudes, what causes poor working conditions and how they can be noted and corrected.

The methods described are based on sound scientific principles and are simply presented. Examples based on actual industrial experiences supplement the text and help the reader understand each technique and procedure the author describes.

In all, the book describes most things needed to make a small organization a more harmonious and efficient working group.

who's meeting and where

Mar. 4-8. National Institute of Management, Inc. Top Management Seminar including such material as human relations, mathematical programming, production and sales forecasting, quality control, production control and inventory management. Alcazar Hotel, Cleveland, Ohio. Details are available from National Institute of Management, Inc., 1008 National City Bank Bldg., Cleveland 14, Ohio.

Mar. 6-8. Pressed Metal Institute. Spring technical meeting, Hotel Carter, Cleveland, Ohio. Request information from institute headquarters, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 6-8. Society of Automotive Engineers, Inc. National passenger car, body and materials meeting, Hotel Statler, Detroit, Mich. For more data, contact society headquarters, 29 W. 39th St., New York 18, N.Y.

Mar. 7. Cleveland Engineering Society. 14th annual Machine Design Conference, society headquarters, 2136 E. 19th St., Cleveland 15, Ohio. Request further details from society, 2136 E. 19th St., Cleveland 15, Ohio.

Mar. 11-15. Nuclear Congress and Atomic Exposition. Convention Hall Philadelphia, Pa. Data is available from exposition office, 304 Architects Bldg., Philadelphia 3, Pa.

Mar. 11-21. Quality Control by Statistical Methods. Tenth annual short course sponsored by College of Engineering, University of Illinois, with cooperation of the Div. of Engineering Extension at Urbana. Prof. John A. Henry, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill., can supply details.

Mar. 14-16. The Society of American Military Engineers. Third military-industrial conference. Conrad Hilton Hotel, Chicago, Ill. Direct inquiries to society office, 808 Mills Bldg., Washington, D.C.

Mar. 18-19. Steel Founders' Society of America. 55th annual meeting, Drake Hotel, Chicago, Ill. Direct inquiries to society office, 606 Terminal Tower, Cleveland 13, Ohio.

Mar. 18-21. American Society of Mechanical Engineers. Second national conference of the society's Gas Turbine Power Div., Sheraton Cadillac Hotel, Detroit, Mich. Obtain details from society's office, 29 W. 39th St., New York 18, N. Y.

Mar. 18-21. The Society of the Plastics Industry, Inc. Annual national conference and Pacific Coast plastics exposition, Hotel Biltmore and Shrine Exposition Hall, Los Angeles, Calif. For more information, contact society office, 250 Park Ave., New York 17, N. Y.

Mar. 19-21. Society of Automotive Engineers, Inc. National Production Meeting and forum, Hotel Statler, Cleveland, Ohio. Write for information to society office, 29 W. 39th St., New York 18, N. Y.

Mar. 25-29. American Society for Metals. Western metal exposition, Pan Pacific Auditorium, Los Angeles, Calif. For complete data, contact ASM offices, 7301 Euclid Ave., Cleveland, Ohio.

Mar. 25-29. Society for Nondestructive Testing. Western states convention

Bushings a bottleneck? Cut production delays. Reduce bushing wear as much as 20% with precision finished Accurate Drill Jig Bushings. ABC Bushings hold dimensional accuracy longer because they're made of chrome bearing steel. **You get them faster, too** . . . . "same day" shipment on all cataloged standard sizes. Custom orders receive special custom service. Eight conveniently located warehouses to serve *you* better. Write today!

ACCURATE BUSHING COMPANY
ASA STANDARD DRILL BUSHINGS • PRECISION PARTS
PIERCING PUNCHES

ABC **443 North Avenue, Garwood, N. J.**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-261

and technical sessions, Ambassador Hotel, Los Angeles, Calif. Write general chairman, Dr. C. Robert Emigh, staff member, Los Alamos Scientific Laboratory, Los Alamos, N. M. for more facts.

Mar. 27-29. American Power Conference, sponsored by Illinois Institute of Technology in cooperation with 14 other universities and 9 local and national technical societies, Hotel Sherman, Chicago, Ill. Further information may be had from the Raymond D. Meade, Conference Coordinator Institute, 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Apr. 1-3. International Acetylene Association. Annual meeting, Nicolet Hotel, Minneapolis, Minn. For details write association office, 30 E. 42nd St., New York 18, N. Y.

Apr. 3. Society of Plastics Engineers, Inc. Regional technical conference, "Plastics for Building," New York City. Direct inquiries to society office, 34 E. Putnam Ave., Greenwich, Conn.

Apr. 7-12. American Chemical Society. Spring Meeting, Miami, Fla. Further facts are available from society office 1155 Sixteenth St., N.W., Washington 6, D.C.

Apr. 8-10. American Society of Mechanical Engineers. Spring meeting, Dinkler Tutwiler Hotel, Birmingham, Ala. For complete information, write society headquarters, 29 W. 39th St., New York 18, N. Y.

Apr. 8-11. American Management Association. 26th annual national packaging exposition and national packaging conference, International Amphitheatre, Chicago, Ill. Request details from society office, 1515 Broadway, New York 36, N. Y.

Apr. 8-12. American Welding Society, Inc. Annual national meeting and welding show, with AIEE conference, Sheraton, Bellevue Stratford and Benjamin Franklin Hotels and Convention Hall, Philadelphia, Pa. For full particulars, write society headquarters, 33 W. 39th St., New York 18, N. Y.

Apr. 9-10. Conference on Electronics in Industry, sponsored by Armour Research Foundation and Institute of Radio Engineers, Illinois Institute of Technology campus, Chicago. Direct inquiries to Conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

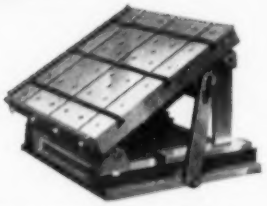
Apr. 14-27. First U. S. World Trade Fair, New York Coliseum, New York, N. Y. Write U. S. World Trade Fair, 331 Madison Ave., New York 17, N. Y. for more details.

Apr. 15-17. Symposium on Information-Handling problems and techniques plus demonstration of systems used for organization, storage and retrieval of recorded information, presented by School of Library Science of Western Reserve University and its Center for Documentation and Communication Research. Cosponsor is Council on Documentation Research. Contact Western Reserve University, office of Public Information, 2035 Adelbert Rd., Cleveland 6, Ohio for more data.

Apr. 29-May 3. Materials Handling Exposition, Convention Hall, Philadelphia, Pa. Data may be had from exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. Concurrently, the American Material Handling Society will hold a conference on new developments in handling methods.

Robbins ...THE COMPLETE LINE OF ANGULAR TOOLING EQUIPMENT

Save dollars in valuable tool room time on every job! Set-ups that require hours by other methods take minutes the Robbins way. Just four simple steps: (1) Look up required angle in Table of Constants furnished with each tool, (2) Select gage blocks from the Table, (3) Place gage blocks between base of unit and sine bar swivel block, (4) Secure the work . . . and you're ready to go! Complete range of models and sizes brings Robbins precision equipment within the reach of every shop, large or small.

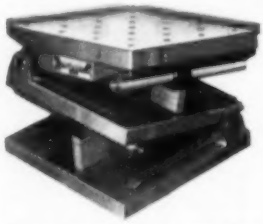


HEAVY DUTY SINE PLATES FOR MILLING AND BORING

Fool proof! Rugged enough to take thrust and chatter of heavy cuts . . . yet built to tool room accuracy for the most exacting inspection operations.

"MAGNA-SINE" MAGNETIC TABLES FOR PRECISION GRINDING

Set up and grind any single or compound angle fast! Work is held securely by magnetic attraction, clamped or released in an instant. Work can't warp or move.



INSPECTION SINE PLATE FOR EVERY INSPECTION OPERATION

Eliminate chance of errors in inspection department and tool room! No more V-blocks, angle plates, or complicated built-up sets of blocks. Simple, fast and sure.

Write or call for complete information now!

OMER E. Robbins COMPANY

24800 PLYMOUTH ROAD DEPT. E DETROIT 39, MICH.

Also producers of special machinery, gages and fixtures

Also manufacturers of special machinery, automatic assembly machinery.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-262

Toolmakers' microscope reads to 0.0001" and 1 minute of arc. Co-ordinate range 4" x 2". Compact built-in rotary stage.

Make precise measurements to 0.0001" and cut rejects with Gaertner microscopes

Here are reliable, easy-to-use microscopes for precise, indisputable measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. With these instruments you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear.

Through the engineering facilities at our Chicago plant, these versatile, well-constructed microscopes can be adapted to meet your exact needs. Find out now how you can gain new production savings with Gaertner measuring microscopes.

Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Scale Micrometer or Shop Microscope

High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

Write for Bulletin 161-54

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.

Telephone: BUckingham 1-5335

INDICATE A-3-263-1

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

What Is Spark Erosion Machining?

Establishing definitions for spark erosion machining methods is needed to avoid confusion and to obtain comparable data, according to J. Reppisch writing in *Zeitschrift für wirtschaftliche Fertigung*. It is important, the author indicates, to measure the accuracy of the cavity produced and surface roughness. Furthermore, data on metal removal per unit time should be available. A so-called work quality factor is defined, being the ratio of metal removed to surface roughness. The larger the metal removal and the smaller the surface roughness, the better the work quality.

Introducing a quantity which represents the wear of the electrode gives the possibility of obtaining a relative wear factor (V) as the ratio of wear (E) over metal removal (M). The larger the metal removal and the less the wear of the electrode, the smaller the relative wear factor, $V = E/M$; hence, the better the wear quality of the process.

The author also relates the metal removal factor to the consumed electrical energy (N), leading to an efficiency quotient $W = M/N$. The overall quality of the spark erosion process can then be numerically indicated by a factor g which equals the product of ratios A by W divided by ratio V. This is equal to the third power of the metal removal factor divided by the surface roughness, the consumed electrical energy and the wear of the electrode.

New Principle of Surface Grinding

Grinding wheels used in surface grinding operations must have a diameter greater than the width of the workpiece in the case of a plain surface grinder or larger than the radius of the table in the case of rotary table

Try a free sample of this amazingly effective WELDING COMPOUND

It will save you money on high priced cutting tools

The product is CRUMCOID, now being used successfully for tipping high speed steel cutting edges to ordinary steel shanks. It produces big savings because now you won't need cutting tools made 100% from expensive tool steel.

CRUMCOID was developed in England and we've made it here in limited quantity for 15 years, selling it on merit alone, with "word of mouth" its biggest booster.

Combining our knowledge with the experience of many customers, we can tell you this:

- **CRUMCOID has proved far better than any brazing powder or cement. It's simple and economical to use. It works equally well in the toolroom, for production and maintenance requirements.**

Some say it produces the most solid weld they've ever had. We quote a long-time customer:

"We first tried Crumcoid successfully on our wider, square nose and shaped tools used in turning rolls, where other compounds would not hold. On the welding of 6", 8" and larger turning tools we find results are excellent when the proper method is followed."

We don't think CRUMCOID can do everything—But we *know* it can do a great deal for you and a lot more than we can tell about here. That's why we ask you to try it in your plant. We'll send the free sample with full information and instructions. You may even find a new application for CRUMCOID we'd like to hear about.

No strings attached to this offer! Just try the sample as soon as possible because we're banking on CRUMCOID to sell itself.

WELDING CRUMCOID COMPOUND

W. D. CRUMPTON & CO.
34 NORTH VAN BRUNT STREET
ENGLEWOOD, NEW JERSEY

O.K., We'll try a free sample of CRUMCOID.

Name .....
Title .....
Company .....
Address .....
.....

INDICATE A-3-263-2

grinding machines. The power required for driving large wheels at high speeds increases considerably with the diameter and similarly, stability of the machine and its cost.

According to an article published by M. Wiest and H. Nierreither in *Werkstatt und Betrieb* of December 1956, small surfaces on large workpieces must be machined on grinders of these types, making it impossible to utilize the machine economically. To eliminate these conditions, a new grinding principle has been developed, the so-called PSM method, consisting of a combination of simultaneous rotation and longitudinal feeding of the workpiece. In this way, it is possible to reduce the size of the wheel substantially, also the weight, required power and the price of the machine.

Another advantage of this method lies in the fact that the cutting forces act mostly in the direction of the greater strength of the workpiece, reducing its deformation and increasing the accuracy of the grinding process, or increasing the feed when the accuracy is satisfactory.

The authors describe in detail the kinematics involved in the combined rotation and feeding of the table obtained by proper "tuning" of rotation —stepless between 1.9 and 16 rpm—of the table and longitudinal motion of a carriage, 2.5 to 40 fpm. Reversal of the carriage is controlled by cams rendering it possible to have the workpiece move in an elliptical orbit or in a triangular or rectangular or other path.

The resultant of the speed of the carriage and of the circumferential velocity of the table establishes the actual feed, so it is possible to eliminate the dwelling of the grinding wheel at the center of a rotary grinding table, which usually generates a considerable amount of heat. This cannot be dissipated fast enough in the conventional grinding; hence, with the new method production time can be reduced by elimination of this source of inaccuracy associated with surface grinding with cup wheels, or with the face of the wheels.

Standards for Surface Finish

New German standards for surface finish have been published and are discussed by H. V. Weingraber in *DIN-Mitteilungen* Vol. 35, October 1956. He also reports on the second meeting of the subcommittee on surface finish of the International Standards Organisation (ISO). The roughness is graded and standardized in geometrical progression with a factor of 1.25. All measurements are based on the metric system using the metric micron (1/1000 mm = 0.00003937 inch) as the measuring unit.

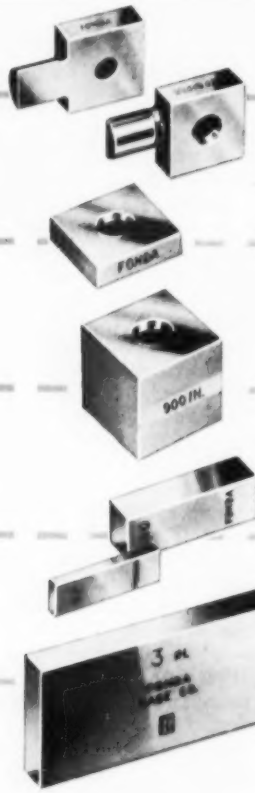
The German standards discussed carry the numbers 4760, 4762 and 4763. Number 4760 refers to the determination of two types of geometrical macroshapes, while No. 4762 deals with definitions of roughness sections and brings the German standards closer to the American standards by introducing the arithmetical mean of all deviations from the mean surface profile. The "depth of smoothness" and the "rake of void" are also defined, including the ratio of the depth of smoothness to roughness. No. 4763 covers the main criteria of surface testing.

Plain Bearings for Precision Machine Tools

Plain bearings with multiple surfaces work virtually vibration-free in grinding machines according to an article by W. Reuthe in *Industrie Anzeiger* 1956, Vol. 78, Nos. 84 and 85. They prevent a breakdown of the oil film when the transversal pressure changes during the grinding operation or during dressing of the grinding wheel.

The position of the spindle is held stable in space in accordance with the

FONDA



goes to every length possible to bring you

ULTRA finish **GAGE BLOCKS**

SQUARE OR RECTANGULAR...IN STEEL OR CARBIDE...WITH ACCESSORIES

Precision in FG *Millionths*

When the order calls for pinpoint accuracy, there can be *no* margin for error! That's why FONDA *Ultra-Finish* gage blocks . . . painstakingly developed and precision engineered . . . guarantee *you* gaging closest to perfection. *Compare!* You'll find FONDA gage blocks and accessories, both price and tolerance-wise, are the *finest* your money can buy! Write *now* for literature and the name of our representative in your area.

D. C. FONDA GAGE CO.

201 HENRY ST., BOX 1050, STAMFORD, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-264

balance of the oil pressure. Calculations for the oil pressures and their distribution are presented. It is claimed that the high hydrodynamic pressures insure high quality surface finish which is obtained by the balanced position of the spindle.

Temperature of the Cutting Edge

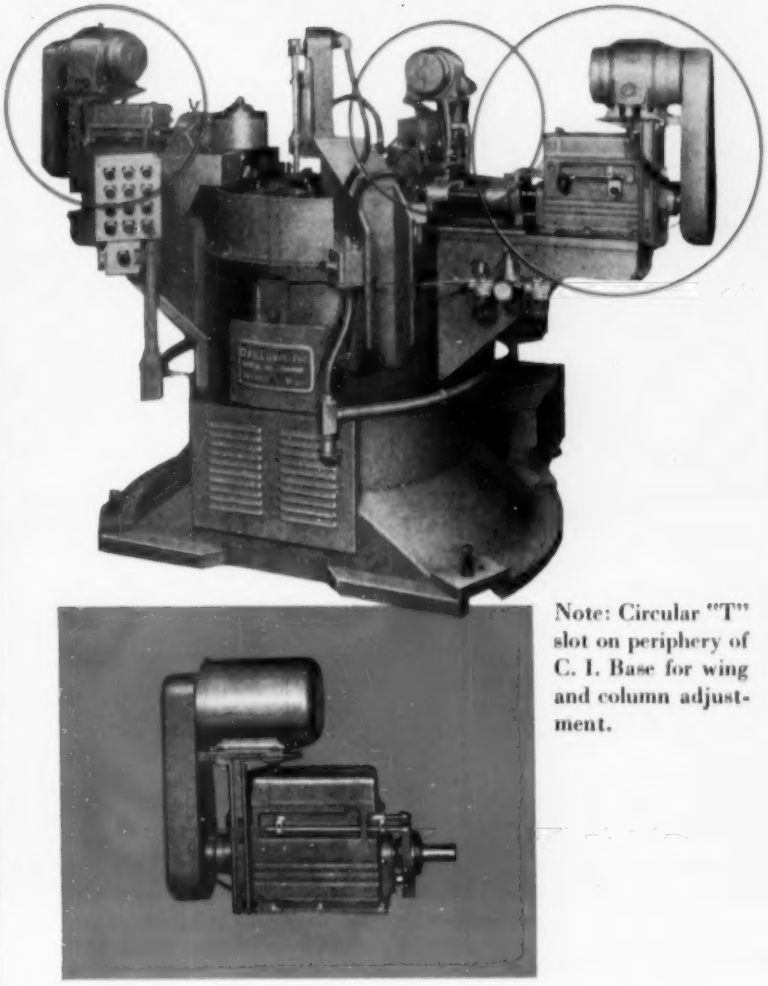
Application of thermocouples in the determination of temperatures at the cutting edge of tools, which were first used by E. G. Herbert in England and by K. Gottwein in Germany about thirty years ago, is described by K. J. Keusters in an article in *Industrie Anzeiger* of November 6, 1956. He welded the thermocouples into small holes in the tool in order to determine the temperature distribution and measured also the wear of the tool. No simple relationship exists, according to the author, between tool wear and temperature at the cutting edge.

Machine Tool Design

Twenty years after the publication of Schlesinger's book on machine tool design, another book on this same topic was published in Germany by *Springer-Verlag*—West Berlin. It is authored by the late F. Schwerd, formerly a professor at the Hannover Institute of Technology. The book covers metal-cutting machine tools in nearly 550 pages and with over 700 illustrations. It omits metal-forming machine tools entirely. The author did not live to see his book published. For this reason, it seems, the problems of vibration have not been taken into consideration.

The book is divided into 20 chapters dealing with a history of the development of the machine tool from 1800 to 1900. This is followed by a chapter on metal-cutting science, which is rather incomplete except for the description of the high-speed photography investigations carried out by the author in 1936 at exposures of 1/5,000,000 second per frame, and published previously. Other chapters of the book cover the standardization of the rpm of German machine tools, mechanical elements and hydraulic elements of machine tools. Another chapter deals with the electrical equipment for machine tools.

Although mostly German machine tools are described, a few American machine tools are considered, such as Gleason, Gisholt, Brown & Sharpe, and others. For the designer interested in basic principles for the development of machine tools such as deformation, cutting forces, stresses, etc., Schlesinger's book is still outstanding, while Schwerd's book is recommended to the designer looking for information on German machine tools up to 1953.



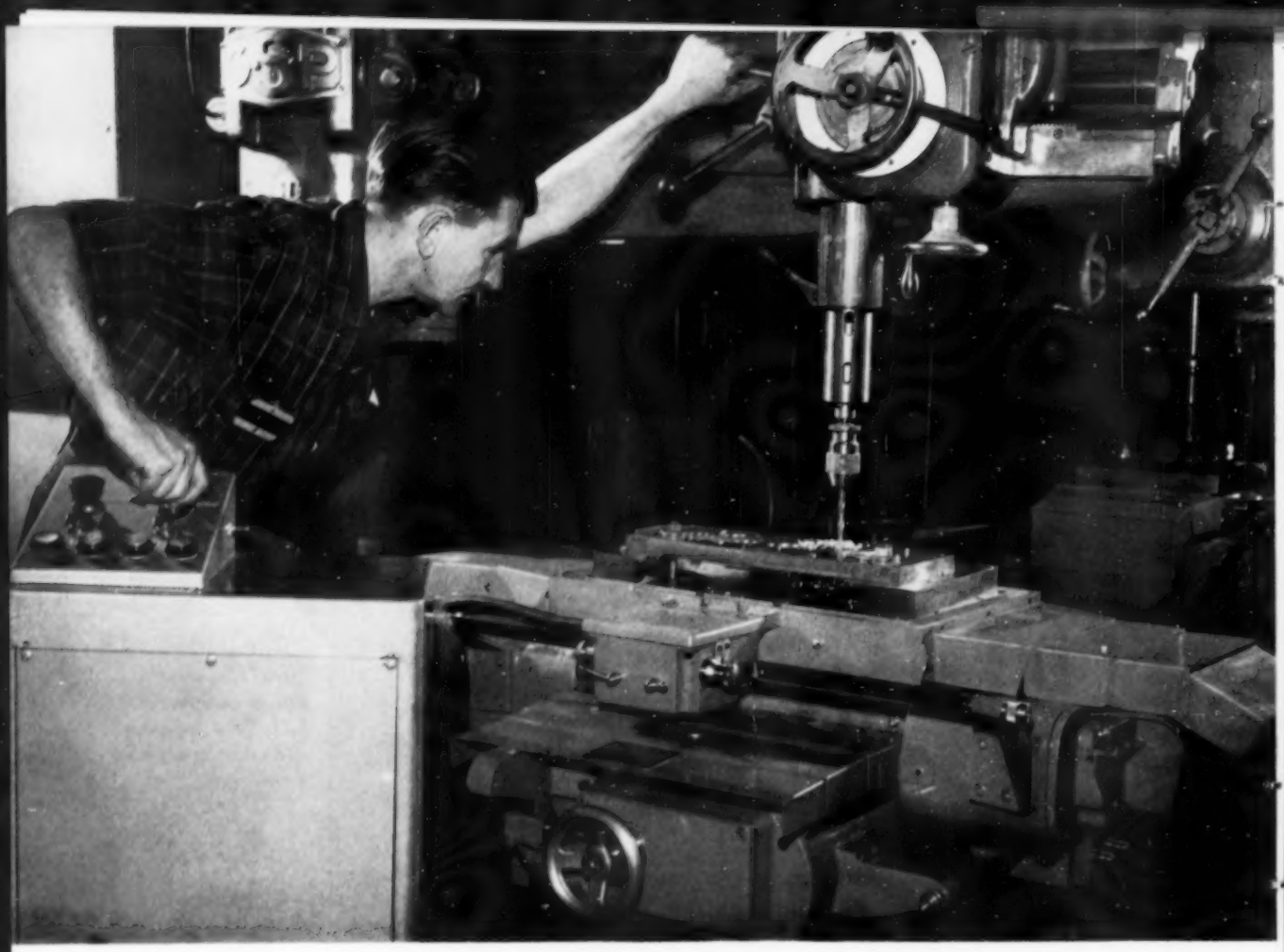
Note: Circular "T" slot on periphery of C. I. Base for wing and column adjustment.

DRILLUNIT STANDARD MACHINES MEET THE DEMANDS OF PROGRESS

This Drillunit machine is built of a standard base, brackets, columns, table, and the powerful Drillunits outlined in red. Because of this, Drillunit specials never grow old, reconvert at 60% to 80% less cost. Meticulously built by Drillunit of Detroit. Write today.

DRILLUNIT

DRILLUNIT INC., 3267 WIGHT STREET, DETROIT 7, MICH.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-265



cuts set-up time,
eliminates jigs and fixtures
on repetitive drilling,
reaming, tapping and
many other operations

MICRO-POSITIONER

tape controlled indexing table

The "MICRO-POSITIONER", automatic indexing table, has effected positive accuracy to .001" by providing an external, visual means of adjustment for indentation sensing and tape relocating. Also, an indenter safety switch prevents any possible indenting unless the tape is installed and mechanism is in indenting position. This table is precision made, simple, fully electric and push-button controlled. It makes possible reproduction of complex drill or tapping patterns repetitively and swiftly with very little effort or skill required from the operator. In operation, one tape controls the transverse movements of the work table and a second tape, the longitudinal movements. These movements are controlled electro-magnetically by an electric clutch which makes split second starts and stops of the lead screws as the switches sense the markings on the tapes. It is compact in design and relatively lightweight. Thus, it may be quickly moved from one machine to another as necessary. When used in combination with radial drills, milling machines, turret drills or other suitable spindles, the "Micro-Positioner" results in a universal production machine of unlimited potential.

For complete information, write Dept. TE-3

THE MICRO-POSITIONER CORPORATION

710 Wilshire Boulevard, Santa Monica, California

Telephone: EXbrook 4-0373

Tech Digests

Automatic Production Lines of the Future

By Del Harder

Executive Vice President
Basic Manufacturing Divisions
Ford Motor Co.
Dearborn, Mich.

AUTOMATION in production has evolved over a long period of time. Among the important steps in this development was the first moving assembly line, and the joining together of special machines by Ford. This was in the late 1930's and a mechanical interlock was used. Later, machine tool builders incorporated these features into the basic design of machines, now commonly identified as the automatic in-line transfer machine.

This combination of automatic individual machines and transfer equipment between machines has resulted in present day automatic production lines. Until recently, it appeared that automation with its enormous investment might tend to freeze design in the automotive industry. Large transfer machines, particularly those for parts such as cylinder block, cylinder head and transmission case, are not easy to adapt to changes in design. It is necessary for product designers to acquire a knowledge of the equipment and do some painstaking planning in advance.

Flexibility Necessary

Even with transfer machines, however, the product designer may be able to make major changes without scrapping equipment worth millions of dollars. This requires certain consideration of locating points, clearance, and overall dimensions.

At Ford, through imaginative thinking, and with the help of many machine and equipment builders, standardized automation sections have been developed so that it is now possible to remove one or more sections and replace them with others, adapted to a new part design.

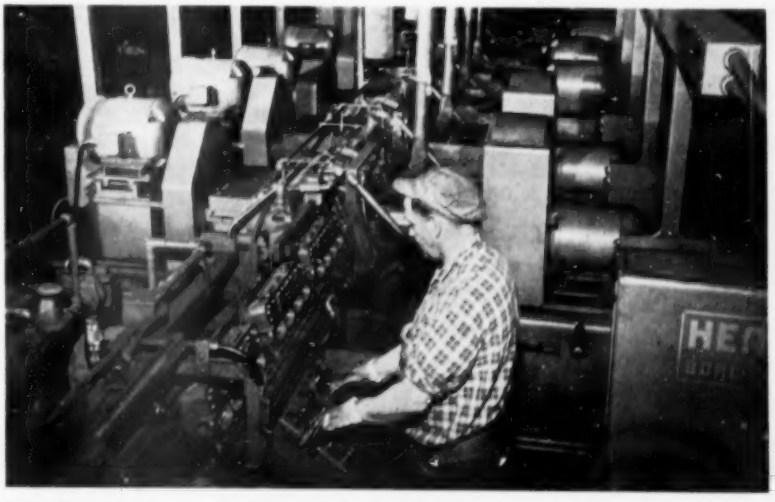
Although a relatively small percentage of employees have been directly affected by automation, where applied it has meant taking drudgery and physical effort out of the job. It has made the job more interesting for the employee and, more important, has made for safer jobs. The reduction of accident rates both frequency and severity, on automated operations has been nothing short of amazing.

This is illustrated in the feeding and ejection of parts from presses, either by air or mechanical means. Prior to use of automatic handling equipment the operator was required to place the piece of stock in the press with hand tongs and then remove it by the same method. Automation eliminated manual handling and the safety hazard was almost entirely eliminated on this type of job.

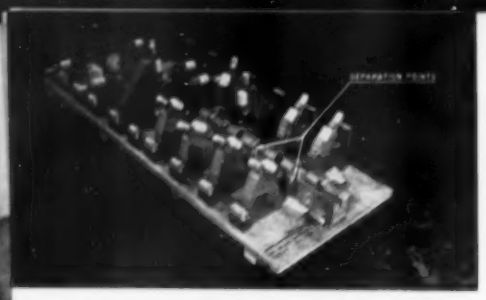
Several types of automatic machines are used in machining lines. Most have some disadvantages. For example, a line consisting of standard machines joined together by conveyances does not lend itself to the automotive industry's production techniques, due to frequency of model changes.

Running changes made during current model production also aggravate the problem. Of course, standard machines are used in automatic production lines wherever they lend themselves to implementation. This type of machine, however, does lack the desired flexibility.

Building block machine tools are the answer to the rapid growth of the metalworking industry as far as automatic production lines are concerned. Use of this building block concept will allow stockpiling of some major machine units and components. It will permit incorporation of technological advances. It will facilitate rapid incorporation of product changes and will avoid freezing of machine design. This concept is



Transfer machine in Dearborn engine plant does exacting job of machining valve guide holes, seats, throats and seat faces with 104 tools in 17 stations.



Model of a building block automation line. Separation points show where machine units can be added or changed.

important for extending the automatic production line into new areas of industrial production.

Automation of assembly has lagged behind machining. For some time engineering skill and knowledge have been available to improve assembly operations. Also the economic climate has become ripe for the attempt to overcome the many problems involved.

Some work has already been done in this field. In automobile production,

Del S. Harder, executive vice president, Ford Motor Co., directs operations of all basic manufacturing groups, purchasing and production programming and control. He has probably been associated more closely with automation than any other man. In this discussion he examines developments in manufacturing from an eminently practical viewpoint.

automatic nut running and bolt tightening have been developed to achieve more uniform torquing. In aircraft industries, standardization is proceeding on riveting operations. Most automatic assembly developments, however, have been confined to small assemblies and subassemblies.

So far, management has hesitated to go into large scale development of automatic assembly of large, complex components because of the risk involved. If a machine with a large number of assembly stations replaces the work of some 40 to 100 operators through automatic assembly, a difficult production situation would arise should the machine break down. Management cannot replace a manual assembly line of this magnitude in short order. One solution of this problem might be a substation bypass.

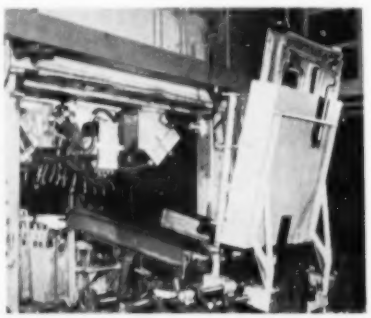
If a means can be worked out by which it is possible to bypass the broken-down station through quick substitution of a station utilizing perhaps four to six manual operations, the practicability of large scale automatic assembly can be increased. As with machining operations, interchangeability of various units and components in such assembly equipment would be a factor in expanding use of automatic assembly techniques.

Unitized Automation Concept

Briefly, the building block idea calls for sectionalized units with standardized dimensions insofar as they affect rearrangement of the sections. If certain physical dimensions such as spindle heights, mounting dimensions and the like are standardized, interchangeability of units—base sections, wing sections, columns, heads, and power units—can be achieved. It is hoped that standardization of dimensions will attain interchangeability and freedom of rearrangement through cooperation of builder and user groups. Unitized machine tools of standard components would be easier to set up. Each station would be a machine in itself, complete with its own electrical and hydraulic circuits. Hence, any given station could be cycled for set-up purposes. More stations on an in-line machine could be set up simultaneously, reducing lead time.

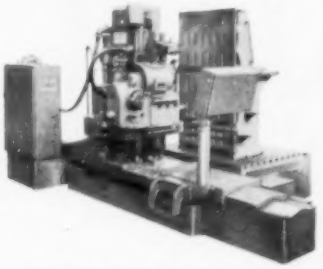
If an operation were needed to be added, the in-line machine could be pulled part, proper units inserted and production resumed.

In industry, design can never be fixed.



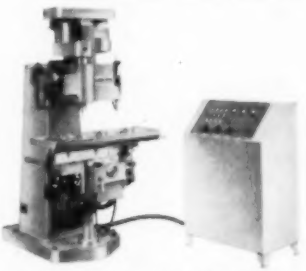
Automatic devices move body stamping through welding operations at Cleveland stamping plant.

A P&W Tracer-Controlled
MILLER
FOR EVERY
JOB

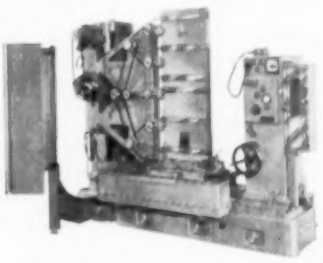


KELLER TYPE BG-21 . . . a powerful, versatile machine in a range of sizes from 5′ x 2½′ to 10′ x 4′, in single and 2-spindle models.

KELLER TYPE BL . . . a compact, powerful Tracer-Controlled Miller for work within the range of 36″ x 20″. With all new Keller features. Single and 3-spindle models.



VELVETRACE® MILLING MACHINE . . . duplicates the finest detail with extreme precision. New, non-contacting tracer control cannot damage the softest, most fragile 3-dimensional models.



AUTOMATIC DUPLICATION MACHINES . . . automatically reproduces original forging dies and glass or plastic molds with remarkable precision and detail. Two versions, one for molds, one for dies, with 1, 2 or 4 spindles.

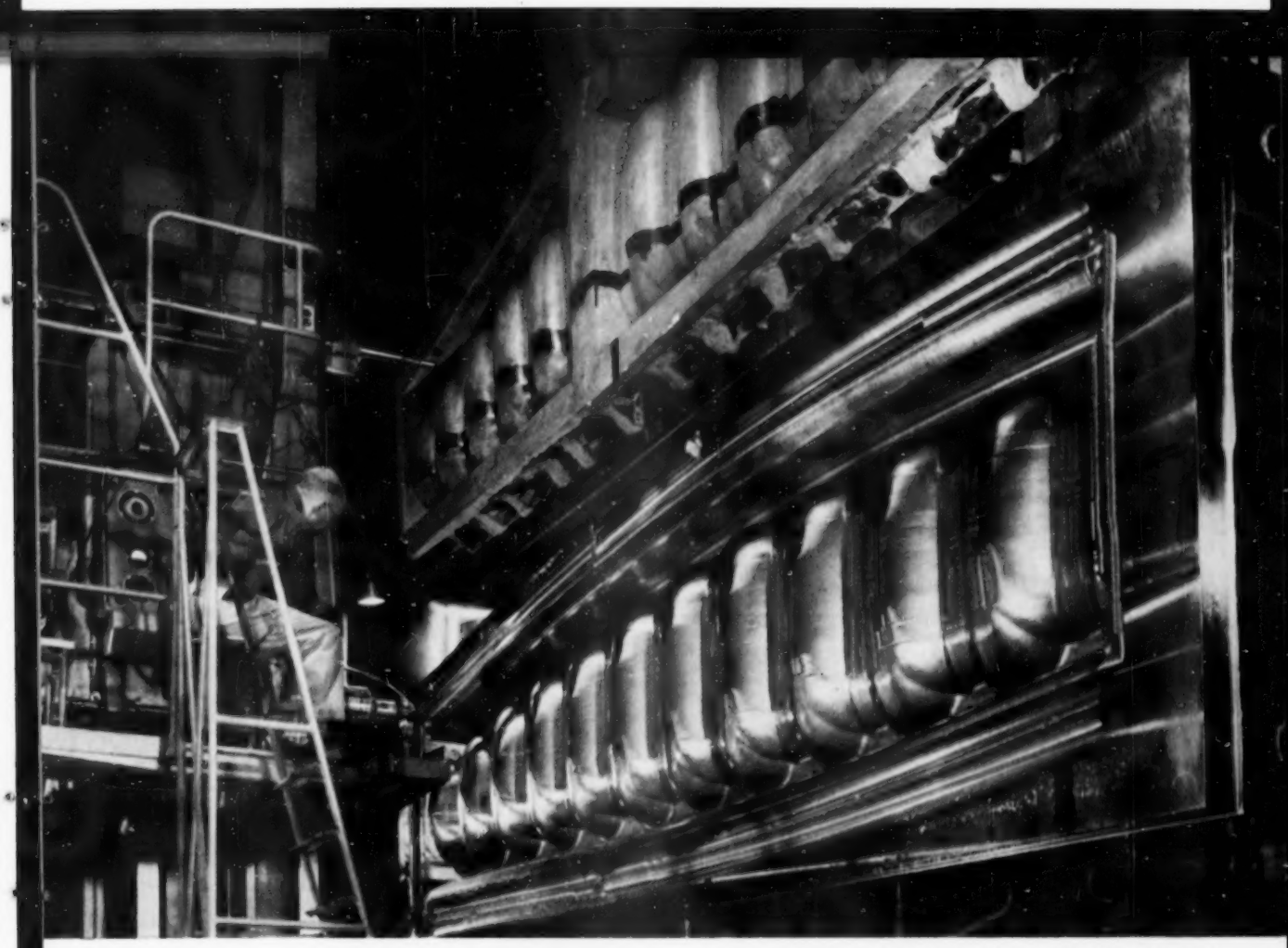


PHOTO COURTESY OF ALUMINUM COMPANY OF AMERICA

To machine the WORLD'S LARGEST DIE,

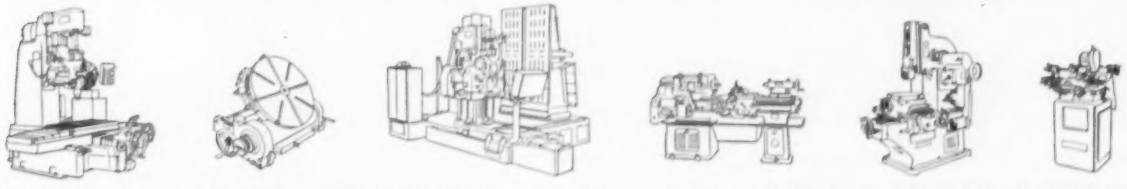
ALCOA chose the Keller . . .

. . . AUTOMATIC TRACER-CONTROLLED MILLING MACHINE

Consisting of two halves, each weighing 30 tons, this is the world's largest closed die block. Designed to forge aluminum backbones of fuselage and wing structures for the new multi-jet Martin SeaMaster, this giant die was produced on a P&W Keller BG-22 at the U.S. Air Force Heavy Press Plant operated by Aluminum Company of America.

Chances are that your own workpieces aren't as large as this die, but there is a Pratt & Whitney Keller Automatic Tracer-Controlled Miller for *every* worksize requirement. *Every* Keller Machine offers the same important advantages: fast, accurate reproduction of complex 3-dimensional shapes, extreme versatility and an overall ability to produce highest work quality economically. These advantages will also make Keller *your* first choice for a wide variety of die, mold and other hard-to-handle 2- and 3-dimensional milling jobs. Write now for complete information.

Pratt & Whitney Company, Incorporated, 16 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

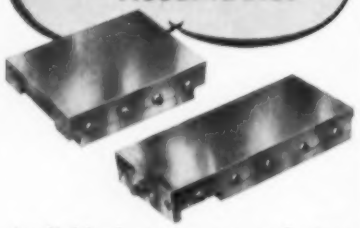
FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

SAVE DESIGNING AND MANUFACTURING TIME
with these
Standard COMPONENTS
FOR *Special* MACHINES

COMPLETE your *special* production equipment faster with *standard* components from this extensive line. Highest precision and quality—many sizes available from stock. *Get complete details!*

STANDARD
Slide
ASSEMBLIES



Available in 52 types and sizes. *Basic Type* includes male and female members, gib and gib screws. *Assembled Type* also has return springs, stop screw, Neoprene shield and mounting holes. Sliding surfaces furnished either *Milled* or *Hand Scraped*. Widths from 2" to 6"—lengths from 3" to 16".

STANDARD
Spindle
ASSEMBLIES

Available in *Collet Type* for ⅛", 3/16" and ¼" max. capacity collets; *Morse Taper Type* for No. 0 and No. 1 Morse taper shanks; and *Arbor Type* for shankless cutters with 0.375" and 0.500" center hole. *Standard Duty* has single row ball bearings at both ends; *Heavy Duty* has double row bearings at front.

WRITE now for FREE catalog!

RUSSELL T. GILMAN, Inc.
627 Beech Street
GRAFTON, WISCONSIN
INDICATE A-3-270-1

Changing desires and habits of the public constantly influence function, size and shape of both the product and machines that make it. Every forward step in technology is the result of change, and competition is the driving force behind that change.

From a paper given before the 55th annual meeting of the National Machine Tool Builders Association, Cleveland, Ohio, at Edgewater Beach Hotel, Chicago, Ill., November 9, 1956.

▼ ▼ ▼

Production Tests of Ceramic and Carbide Tools

By W. I. Phillips
A. O. Schmidt
G. F. Wilson

Kearney & Trecker Corp.
Milwaukee, Wis.
and

I. HAM

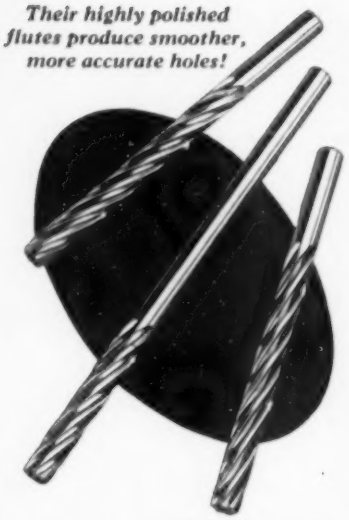
University of Wisconsin
Madison, Wis.

Recent improvements in the mechanical properties of ceramics have led to the successful use of these materials as metal-cutting tools in the shop. Just as carbides forced tool engineers to re-examine tooling and machine tool requirements, the new ceramic tool materials will influence present-day production techniques. They will force further consideration of the design, mounting and grinding of tools.

Increased rigidity, adequate speed and feed ranges and sufficient power must be provided in machine tools to utilize the full potential of ceramics. In drawing attention once again to these factors ceramic tool materials will have made a major contribution to the art of cutting metals. The inevitable improvement in machine conditions fostered by these materials will also help to improve the performance of carbide and HSS tools. These ceramic materials will thus at the same time be an aid and a challenge. For example, recently developed carbides and cermets contest ceramics at speeds and feeds recommended for ceramics.

In the near future many metalworking shops must consider production applications of ceramic cutting tool materials. For a long time ceramics for this purpose have been tested in the laboratory and some have already found successful application in production setups. These materials have seen great improvements within the

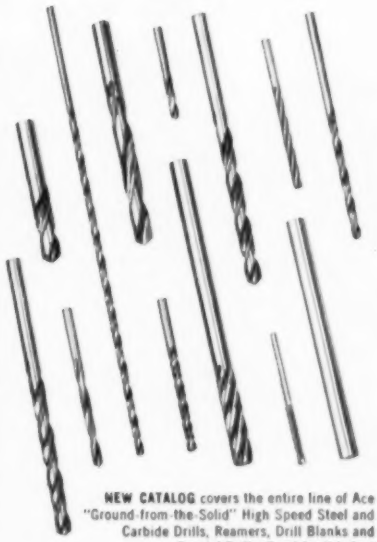
Their highly polished flutes produce smoother, more accurate holes!



ACE
Drill Length and Chucking
REAMERS

For the finest reamers that money can buy, always specify "ACE"! They're made of top quality, prehardened high speed steel and produced by the Ace-originated "ground-from-the-solid" process. Results? Stronger, more highly polished right hand spiral flutes. Keener, longer lasting cutting edges. Plus smoother, more accurate holes at lower cost!

Call your local Ace Drill Distributor today!



NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

INDICATE A-3-270-2

past year. As with every new development, there are at the start a number of obstacles to overcome. Various considerations should be kept in mind when contemplating the use of ceramics.

Ceramic Tooling Principles

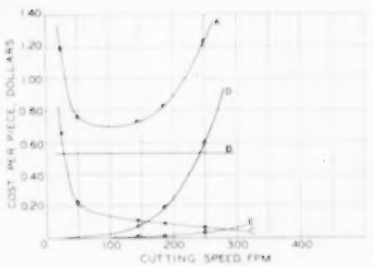
Ceramics are no cure-all. Excessive vibration in a machine tool, looseness in the slides and deflection in the workpiece and tool are likely to cause immediate failure in ceramic tool tips, whereas under the same conditions, a strong grade of carbide can perform quite satisfactorily.

With an increase in cutting speed there is an increase in volume of metal removed per unit time and a corresponding increase in power required. Since ceramics usually cut between two to three times as fast as carbides, the power required will be higher in the same proportion. However, a machine designed and powered for use with carbide tools, and in good working condition, will usually do a credible job with ceramic tools.

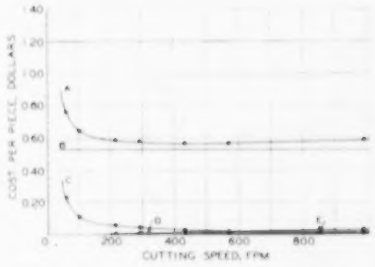
Operators and foremen in the shop must be briefed thoroughly about the possibilities and limitations of ceramics as well as the requirements of chip guards. Initially, it is advisable to confine tests to a single machine tool and to try to machine those aluminum, plastic, cast-iron and steel workpieces which, because of abrasiveness, entail excessive wear on carbide tools. A job which is tooled up completely with carbide tools and gives optimum results, will usually not be improved simply by converting to ceramic tools. On such carbide tools may even prove to be superior to ceramics.

Difficult, interrupted cuts with attendant mechanical shocks which certain carbide tools can withstand may cause more brittle ceramic tools to fail. However, even rough forgings and castings have been successfully turned with ceramic tooling after a certain amount of experience has been acquired. The ceramic tools used in these tests were of an aluminum oxide type, having high resistance to mechanical impact and thermal shock along with high hardness and inertness to chemical attack at temperatures encountered in metal-cutting. Ability to withstand abrasive conditions will be one of the major assets in the application of ceramics as tools.

An important problem in application of ceramic tools is adequate protection of the cutting edge against work-hardened chips which strike the cutting edge outside the region of cutting, causing major chipping and subsequent breakage. This situation can be materially improved by using a proper side-cutting-edge angle and chip breaker especially shaped so as not to permit the chip to impinge on a part of the cutting edge which is not actually cutting.



Production cost in relation to cutting speed for sample part, carbide tools.



Production cost in relation to cutting speed for sample part, ceramic tools.

It has already been demonstrated that for certain turning operations ceramics are the best tool material. Up to now ceramics have not worked as well in milling operations as have other tool materials, but it can be anticipated that this situation undoubtedly will be

First Showing!
KNIGHT'S
NEW NO. 60
Metalworking's most accurate, fast and
VERSATILE VERTICAL
PRECISION BORING...and MILLING
• Unusual extra capacity
• Solid table support
• Choice of 3 measuring devices
• Big heavy bed-type table
• Extra cross & vertical travel
• Easy simplified operation
Send for brochure
ATTACH TO COMPANY LETTERHEAD
TWO TABLE SIZES
18" x 52"— 28" longitudinal travel
18" x 60"— 36" longitudinal travel
KNIGHT
W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd. • St. Louis 8, Mo.
W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd., St. Louis 8, Mo.
Send complete information on new No. 60 Vertical.
Name
Title
☐ Have representative call.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-271

improved in the future as more experience and knowledge is acquired.

Attention once again must be focused on reducing the handling or load-and-idle time which constitutes a major part of the production cost in machining with carbide tools and, with ceramic tools, may account for as much as 90 percent of the production cost of a machining operation.

New Techniques Needed for Ceramic Cutting Tools

Although much remains to be learned about the technique of machining with ceramics, the great potential economic benefits to be derived from use of these materials in many cases is evident, especially in the mass production of machined parts with special or automated equipment having extremely low values of noncutting time. In essence, these economies stem from the greater metal removal rates that are practical with ceramics and from the utilization of the concept of "throw-away" inserts which is admirably suited to these nonstrategic and relatively inexpensive materials. Such benefits have already been accomplished in isolated instances and more widespread exploitation is inevitable.

From a paper No. 56-A-218 presented at the 1956 Annual Meeting of American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Now . . . Cold Extrusion of Titanium

By A. M. Sabroff
O. J. Huber
and
P. D. Frost
Battelle Memorial Institute
Columbus, O.

Cold extrusion of metals, particularly steel has become a well-established and important manufacturing process. Principal application of the process were formerly in production of ordnance items such as mortar and artillery shells and cartridge cases. More recently, however, the process has gained considerable attention from the automotive industry for production of small parts such as wrist pins, hydraulic-valve plungers and electrical switch housings. Some advantages gained by cold extrusion are:

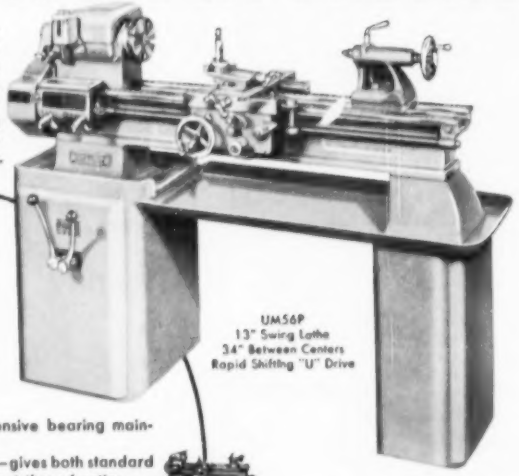
1. Conversion of low-strength alloys to high-strength finished

"Nice work, Higgins!"

SHELDON
CHICAGO U. S. A.

BUILT
• • • to Turn out PROFITS

Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to do most toolroom work.



UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

Design Features:

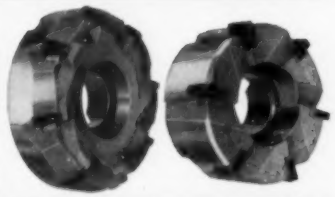
- Large and wide "Zero Precision" Tapered Roller Spindle Bearings—permit operation at all speeds, retain accuracy, end expensive bearing maintenance costs.
- 54-pitch Gear Box—gives both standard and many hard to get thread ratios.
- Large Micrometer Dials—Make accurate operation easier.
- Extra Collet Capacity—1⅜" hole through spindles available on 10", 11" and 13" swing lathes.
- More Power to Spindle—Efficient drives with bigger motors and double neoprene cog V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

Write for New Catalog G-55

SHELDON MACHINE CO., Inc.
4229 N. Knox Ave. • Chicago 41, Illinois
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-272

Faster Milling . . . at lower cost!



NEWCOMER RC MILLING CUTTERS

using "THROWAY" Carbide Inserts . . . another *"Years Ahead"* development

The new RC Milling Cutter combined with Newcomer "Throway" Carbide Inserts is the answer to higher milling production at lower cost! Mechanically held inserts with proper clearances permit heavier feeds and faster speeds.

Easy to Index!

Patented Super "Jack-Lock" facilitates removing worn cutting edge and reindexing to new cutting edge.

Uses "Throway" Carbide Inserts

Carbide grinding time and costs eliminated. Worn inserts are discarded. Insert stocks are kept to a minimum . . . Bottlenecks in grinding room are eased.

Cutter Inventory Slashed!

One cutter body used to mill both steel or cast iron by using proper grade of Newcomer carbide. Cutter stocks are minimized . . . Fewer cutters necessary as job will no longer have to wait on overtaxed grinding rooms.

Designed for Long Service!

Two piece construction of hardened cutter bodies minimizes replacement cost. Mechanically held carbide inserts cut breakage to a minimum.

Call your Newcomer representative, or write...

Newcomer Products, Inc.
LATROBE, PA.
General Sales Office:
512 Franklin Ave.
Pittsburgh 21, Pa.
CHurchill 1-4060
BRANCH OFFICES IN PRINCIPAL CITIES

INDICATE A-3-273-1

products by work-hardening.
2. Saving of time and material because of fewer operations and less machining.
3. Production of an uninterrupted fiber flow, which results in greater load-carrying capacity.
4. Good surface finish and maintenance of tolerances within close limits.

Ability to form intricate parts from titanium in a few simple operations, with small machining loss would be a particular advantage in view of the high cost of this material. The process has never been applied to titanium in commercial practice. This is true probably because of a lack of a suitable surface coating, which is the principal requirement for successful cold extrusion.

Research at Battelle on surface coatings for titanium to prevent galling and seizing, a surface treatment was developed that produced excellent results in wire and tube drawing and reciprocating and rotary wear tests. The treatment, which consists of immersion in a fluoride-phosphate bath at room temperature, produces an adherent, continuous coating on titanium that performs as a lubricant retainer and gliding agent. In view of the outstanding performance of this coating in preventing galling and seizing, it appeared that cold extrusion of titanium can be accomplished successfully.

Extrusion tests were performed on a 700 ton hydraulic press similar to those in use for cold extruding steel. Tools consist of a punch, container, interchangeable dies and ejector.

The die design adopted was one that has been applied successfully in cold extruding steel. A detail drawing of a typical die is shown in *Fig.* 1. The first die land is the bearing surface of the die. Lower lands are larger in diameter and act as guides to prevent buckling of the extruded bar during ejection.

Reductions up to 60 percent were

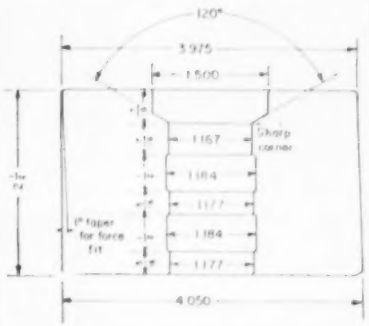


Fig. 1. Typical design of die for cold extrusion of solid round titanium bars.

These are typical of the many piece parts being balanced on the *low* cost, *high* production

TAYLOR

HI-EFF

BALANCING MACHINES

with

Speed Button Control

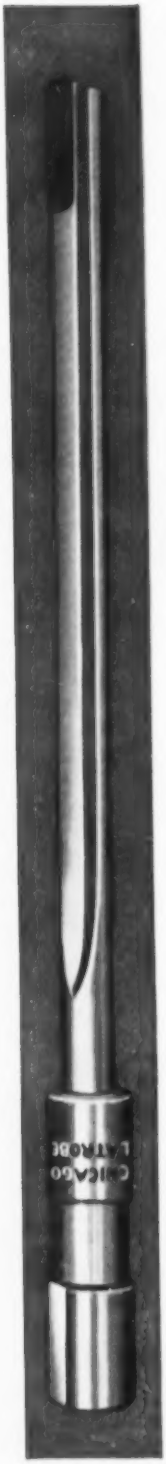
Send your piece parts for sample balancing or drawings for recommendations by Taylor engineers.

TAYLOR DYNAMOMETER and MACHINE COMPANY

DYNAMOMETERS • BALANCING MACHINES
DRILLING MACHINES

5411 River Parkway, Dept. TE, Milwaukee 13, Wis.
INTERNATIONAL DIVISION—DUMMANN WORLD TRADE CO., Milwaukee 6, Wisconsin, U.S.A.

INDICATE A-3-273-2



"All he did was suggest Chicago-Latrobe Gun Drills..."

More than one production man has pulled his shop out of a tough spot by discovering that Chicago-Latrobe gun drills offered a new and practical way to do certain difficult drilling jobs. Consult your Chicago-Latrobe distributor. He's had wide experience in this specialized field, and he has a C-L Service Engineer available to him who rates as the final authority on gun drilling.

Chicago-Latrobe

GUN DRILLS

WITH SOLID HEADS OR CARBIDE TIPPED

FROM YOUR C-L DISTRIBUTOR

DRILLS · REAMERS · CARBIDE TOOLS · COUNTERSINKS · COUNTERBORES · SPECIAL TOOLS

DOUBLE CIRCLE TOOLS

CHICAGO • LATROBE

434 W. ONTARIO STREET · CHICAGO 10, ILLINOIS

OFFICES AND WAREHOUSES

NEW YORK · DETROIT · CHICAGO · LOS ANGELES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-274

accomplished successfully with solid billets of unalloyed grades. Billets were extruded at a speed of 6 ipm measured as punch speed, except for one test in which the speed was increased to 20 ipm. A comparison of the data indicate that higher speeds may be more desirable in that the pressures required both for initiation of flow and for the extrusion were lower. Additional studies would be required, however, to establish optimum extrusion speed.

Pressure measurements during extrusion were made with a hydraulic pressure recorder which measured the pressure on main land as a function of punch travel. Pressure curves for grade AMS 4900 (47,000 psi yield strength) showing typical effect of extrusion reduction on the extrusion pressure required with 120 deg die are in *Fig.* 2.

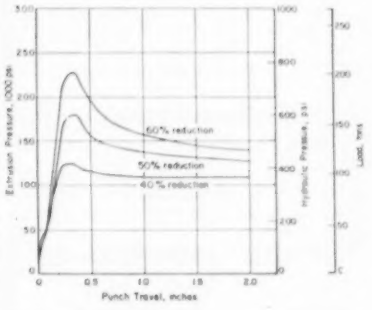


Fig. 2. Extrusion pressure curves for grade AMS 4900 unalloyed titanium, extruded through 120 degree conical die, show effect of extrusion reduction.

Although experimental work conducted in this research was of a preliminary nature it has demonstrated that unalloyed titanium can be cold extruded successfully. The flouride phosphate coating, in combination with a suitable lubricant, was effective in preventing seizing between workpiece and die and in producing a good surface finish. Working pressures were comparable to those required for cold extrusion of steel under similar conditions.

Work hardening during cold extrusion resulted in increases in strength of 25 to 60 percent, yet adequate ductility was maintained. Thus the process offers a means whereby unalloyed titanium can be shaped, without machining, and simultaneously strengthened to make it suitable for application in which it might otherwise not be useable.

From a paper No. 56-A-88 given at the 1956 annual meeting of the American Society of Mechanical Engineers, 29 West 39th Street, New York, New York.

▼ ▼ ▼

You Can Rely on a

ROUSSELLE

THESE 40-TON PRESSES

take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very *moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO.
2310 WEST 78th STREET
CHICAGO 20, ILL.

INDICATE A-3-275-1

Cooperating to Safeguard the Future Water Supply

By C. K. Rice, Coordinator
Refinery Technology Lab.
Gulf Oil Corp.
Philadelphia, Pa.

Adequate water supplies are becoming a serious problem to industry as well as the public and governmental agencies. As consumption has increased, so has pollution. To solve this problem, it is necessary to join forces and face the future together. The extent to which pollution exists must be measured and the sources of pollution established. Then a method of correction and abatement must be concocted. To realize the greatest success in achieving these objectives, it is essential that government agencies, industry and the public unite to form a working team. Threats, promises and indifference must go. Mutual understanding and cooperation must prevail.

Phenomenal advances have been made in the field of chemical analysis and physical testing within the last decade or two. Techniques, instruments and reagents are available which were not dreamed of ten or twenty years ago. Yet, no matter how clever the analysis may be, no matter how precise and accurate the method of tests may be, the end result can never be better than the sample obtained in the first place.

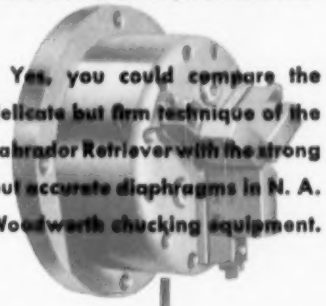
FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

Much thought and planning need to be given to the sampling procedure, equipment used and time and place for taking the sample. Outstanding contributions in gathering and disseminating technical information are being made by various technical societies in this country and abroad. An outstanding pattern of cooperative effort has been designed and is being used in the east by the Ohio River Valley Water Sanitation Commission. While progress is not so rapid as might be desired, it is sound progress. Great advances in the study of stream pollution abatement and measurement of polluting materials can be foreseen from this co-operative work.

There are many other programs under way in this country also. Societies and government agencies are working together to establish uniformity in tech-

HOLD IT!

WITH WOODWORTH CHUCKING EQUIPMENT



Yes, you could compare the delicate but firm technique of the Labrador Retriever with the strong but accurate diaphragms in N. A. Woodworth chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of Woodworth chucking equipment.

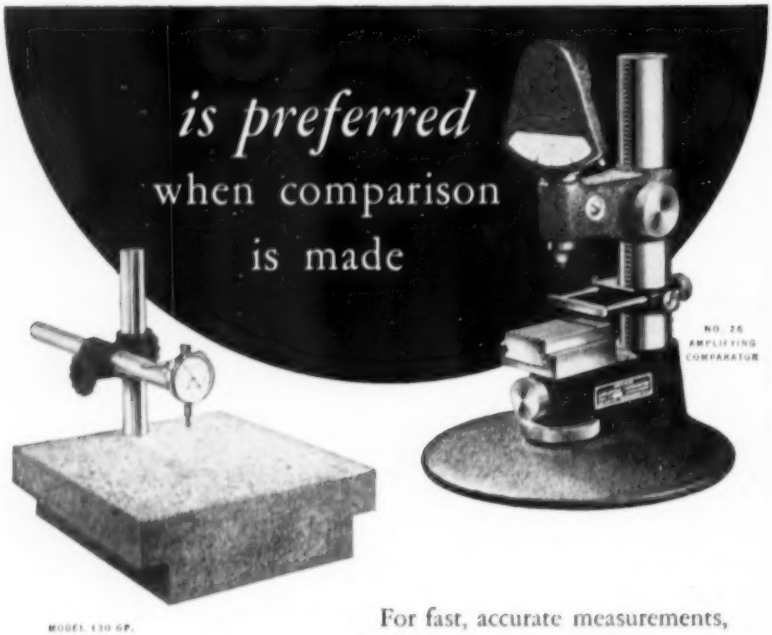
• Standard Diaphragm Chuck • Air-Operated Diaphragm Chuck • Bevel Gear Chuck • Double Diameter Gear Chuck • Finger Chuck • Air-Operated Diaphragm Arbor • Push-Lock Arbor • Twist-Lok Spline Arbor • York-Lok Collet Arbor • Zero Spindle Inspection Fixture

"Accuracy you can trust"

INDICATE A-3-275-2

AMES

is preferred
when comparison
is made



MODEL 130 GP.

For fast, accurate measurements, Ames Dial Comparators are the choice of quality control men everywhere. You get definite, impersonal readings directly from the dial. There's no guesswork or figuring.

Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.

Representatives in principal cities

B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-276

nical aspects of methods for testing and analyzing water. Establishment of a pollution load limit must be carefully thought out and approached with caution. Ultimate use of the receiving stream must be considered. These are multiple; however, the eight principal uses are:

1. Public water supply
2. Irrigation and other agricultural uses
3. Industrial processing and cooling
4. Recreational and esthetic pursuits
5. Navigation
6. Sustenance of aquatic life
7. Hydroelectric power generation
8. Waste disposal

To be realistic, it is not enough to know who is guilty of water pollution. It is insufficient to know to what extent pollution exists. It is necessary to do something about the abatement of pollution, to eliminate that which exists. Common sense is needed rather than extremes. Consideration must be given cost of abatement, technical limitations and obligations to the public.

A good start has been made. Yet, all concerned must work together to an ever-increasing degree to keep the land green and productive with ample water resources for present and coming generations.

From a paper given at the Second Pacific Area National Meeting in Los Angeles, 1956, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

▼ ▼ ▼

Reaching a Scientific Make-or-Buy Decision

By James F. Brinkerhoff
Factory Manager
Argus Cameras, Inc.
Ann Arbor, Mich.

Two years ago the company felt it was an appropriate time to review production planning and scheduling functions. Specifically it was wondered whether the techniques of Operations Research could be used for this purpose. The management particularly wanted an external review to help establish concrete goals and standards of performance. With the outside consultant a company committee was established for this purpose. Particularly the make-or-buy decision for specific parts has been what is best described as a seat-of-the-pants approach. The Operations Research group started

by collecting available data from accounting, purchasing, production and other departments.

A form was then drawn up to effectively present the data collected. This data, in conjunction with specific information concerning a part number is used to calculate the unit piece-price of a part. Thus, it is possible to calculate the make-unit price, the purchase-unit price and finally the profit advantage.

This latter figure, the profit advantage, is the unit cost differential multiplied by expected number of pieces the machine will run in one hour. If it is a positive figure, it is more advantageous to make. If negative, it is more advantageous to purchase.

Production Planning Gains

As a result of these studies, it is now possible in the production planning department to maintain lists, by classes of machines and in order of declining profit advantage. Once the list is established, it is easy to determine for any given production level, which parts would be purchased and which would be scheduled in the plant. Naturally, the company selects from the list parts of greatest profit advantage.

Use of this purchase-make decision procedure has resulted in thousands of dollars annual savings to the company. It has afforded the opportunity to apply judgment where judgment is required and to use facts where facts are available. It not only speeds the decision-making process, it makes better de-

"Unless you cut down the friction here, the design is no good!"

SEND FOR YOUR NEW Atrax "STANDARD REFERENCE" on SOLID CARBIDE TOOLING!

We're very proud and pleased to announce the latest and largest edition ever of the Atrax Catalog is now ready for distribution.

100 colorful pages, crammed with the most complete line of precision, solid carbide tools available—and with vital, useful information on the use, care and maintenance of Solid Carbide Tools.

See hundreds of standard End Mills, Burs, Reamers, Drills, Routers, Grinding Tools and Special Solid Carbide Tools Engineered to keep your production breaking new records! A 28 page price list will be included. These two necessary references to tooling service, superiority and economy are yours by return mail—FREE!

Atrax

Send for your copies . . . NOW

Atrax

Finish FIRST with Carbide!

THE ATRAX COMPANY
Newington 11, Connecticut

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-277

cisions possible and allows these decisions to be made at the lowest supervisory level consistent with the management development program. Not only is it of dollar and cents value but it has the further advantage of allowing the company to effectively broaden a fundamental policy of participation management.

Today the same form is used to help in decision as to whether to purchase or make a new part for a new camera or projector. This also helps decide what kind of tooling should be used on a given part or product.

With this process it is possible to decide for a stamping whether a progressive die or a series of simple and compound dies should be used for a given part.

It helps compare, in terms of product life expectancy, the piece-price which would generate as a result of any known fabricating method. It helps decide whether such tooling should be designed and built inside the plant or designed by Argus and built outside, or designed and built on the outside complete. Thus, known costs are being used in an organized fashion. The procedure is also used to provide cost data necessary before purchase of capital equipment. The data can be used to show both machine need and savings which will result from its purchase.

From a paper given before the 1956 OR seminar of the American Management Association, 1515 Broadway, New York 36, N. Y.

▼ ▼ ▼

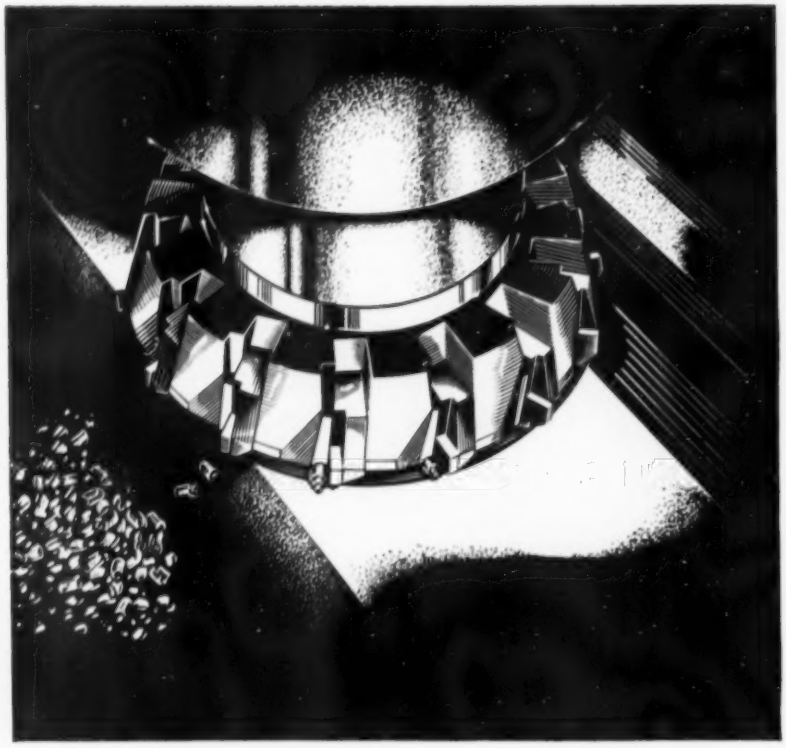
Computers Cut Manufacturing Paperwork

By Howard H. Marlow, Jr.
Staff Assistant
International Harvester Co.
Chicago, Ill.

Today a digital computer processes piecework and daywork payrolls in two hours compared to some eight hours formerly. In the area of materials control, which also encompasses production scheduling, the machine is normally used for about 20 hours per month.

Wherever paperwork flows in the plant, the aim is to mechanize it through punched card routines. By attempting to minimize key punching effort, key punched cards are designed when possible to be a source and end-use document.

The calculator department is operated strictly as a service bureau for any plant department, staff, production or



"MISTREATED MASS PRODUCTION MANIAC"

That's the inserted blade carbide tipped milling cutter. Here's a tool that really outperforms ordinary milling cutters when it's used right. It makes possible increased production with more pieces per grind and better finishes at lower cost.

Economical milling with carbides requires careful tool engineering. This has been recognized for many years at Go & Go. Failure to do so has soured many a carbide application.

Go & Go produces a complete line of inserted blade carbide milling cutters including tools designed for specific jobs (specials). We think they're the finest you can buy because sound engineering comes with these cutters. If your application isn't right for them, we'll tell you so. And we'll tell you how to make it right.

For specifications on a really complete line of inserted blade carbide milling cutters, ask for Catalog "F". Or better still, consult the Go & Go engineering sales representative in your area.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-278

maintenance. All controls for the accuracy of tabulating work have remained with the department utilizing the tab service. The digital, magnetic drum type computer has an alphabetic device as an added feature. This was necessary since the unit was intended to process material and production control or scheduling work in addition to payroll accounting, cost and general accounting, billing and other new work which might be added.

Scheduling by Computer

The West Pullman Works of the company has about 20,000 active parts in process during a typical month. The bill of material file accounts for the handling of some 40,000 cards per month. A typical material control program is the processing of manufacturing schedules and preparation of packing lists. In this problem the computer is fed with the schedule cards for each part and with the master part card. In one pass through the computer the following objectives are realized:

1. Accumulate the current month's order for like part numbers.
2. Advance the next month's schedule.
3. Calculate schedule for balance of current year.
4. Test schedule card to determine if it represents a domestic, foreign, stock, or intraplant order.
5. Calculate amount of raw material necessary to manufacture each part number.
6. Determine if order is for ball bearing; if so, apply coding for packaging standard to the schedule.
7. Determine if order calls for rivets; if so, convert weight ordered to number of pieces for manufacturing count.
8. Determine number of full-weight cartons required for shipment and punch result on packing list cards.
9. Determine quantity and weight of any odd-weight cartons necessary to complete the order, punching the result on the packing list card.
10. Reconcile packing list card quantities to manufacturing schedule card quantities.
11. Punch all necessary manufacturing schedule cards and packing list cards.

This heavy-volume monthly job formerly required 24 hours of machine time and is now completed in thirteen hours of which ten hours represents the pass through the computer.

Other tangible savings have enabled the company to perform breakdown of assemblies into simple parts requirements in three hours, compared to the old method's 15; the complete raw material schedule is finished in only four hours vs a former 32 hours.

Some of the heaviest computer work occurs in the area of costing. Some 40,000 cards in the bill of material file must be projected into all of the individual labor operations on simple parts plus assemblies. For instance, direct labor cost by operation file includes some 150,000 punched cards.

Obviously, the job of estimating costs has been greatly simplified by the possibility of machine processing. In addition, this work can be done on a much more accurate basis.

In addition, the computer permits many other operations on cost reports and monthly statements, such as spreading of burden charges accurately, which were practically impossible previously. While the digital computer has become just another office machine, it certainly does more, better and faster work. It is a wonderful tool of management. The revolution in office methods is just beginning and those who are experimenting with these electronic data processing techniques will find they are ready to move into the more efficient methods that will be possible in the future with such equipment.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

From a paper given before the Computers' Applications Symposium, October 1956 at the Armour Research Foundation of Illinois Institute of Technology, Chicago 16, Ill.

Costs go DOWN

...with New ROTATING Drill Heads and Tapping Heads by WISCONSIN

Custom designed and built to fit all types of Automatic Lathes and Chucking Machines.

Wisconsin Rotating Drill Head with planetary gear drive.

Adjustable and Fixed Spindle Drill Heads and Tapping Heads, Lead Screw Tapping Units, Special Machines, Fixtures, Fixture Bases, Index Tables. Write for literature.

WISCONSIN DRILL HEAD CO.

4985 N. 124th STREET • BUTLER, WISCONSIN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-279

Opportunities Unlimited For Engineers in Manufacturing

By Louis C. Goad

Executive V. Pres.
General Motors Corp.
Detroit 2, Mich.

Americans, and nationals of other lands where people have learned to manufacture abundantly, are living fruitfully and multiplying. Engineers in manufacturing are engaged in making the best possible use of materials and energy available. It is laudable far beyond the cost saving on the product to hold down scrappage and waste of every kind.

Engineers are important users of irreplaceable natural resources and have command of the energy through machines and men by which the products the country needs and desires are created. They more than others are aware that the labor content of this combination of labor, capital and natural resources is made up of one-tenth horsepower men, and that it is the most important element because it is human. Helping to make these human beings more effective with muscles that will not get any stronger is one of the most important objectives of the engineer in manufacturing.

Before the Civil War it was a rare plantation that had as many as 30 slaves. But that is the energy equivalent which has become available through improved manufacturing processes to the average U. S. workman.

Brainpower has been substituted for muscle power at every turn; machines have extended the value of muscle power at a fantastic rate. Better and better machines have resulted from man's ingenuity.

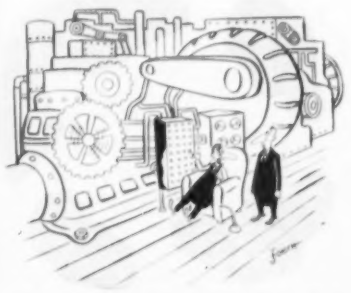
Engineers have learned that invention begets invention and technological progress breeds more technological progress. It is necessary however, to manage skillfully enough to have the capital available to seize upon the gains.

Looking at the future, the labor force is shrinking in relation to the total expanding population. Partly this is because of the low birth rate during the depression years. Partly it is because of the tremendous recent increase in births. Partly it is because of longer educational period. Partly it is because people are living to an older age.

The new America represents at once the challenge to engineers in manufacturing and the vast opportunities for them. By applying knowledge and skill at his command, the engineer can continue to make life in United States abundant, to remain master of its materials and energies which are even now waiting to be mastered for the benefit of all.

From a talk given at the 1957 annual meeting held in Detroit of the Society of Automotive Engineers, 485 Lexington Avenue, New York 17, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT



"Either you cushion these buttons or I quit!"

TRUE QUALITY for CLOSE TOLERANCES with

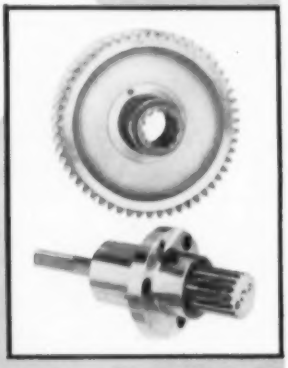
Splinemaster

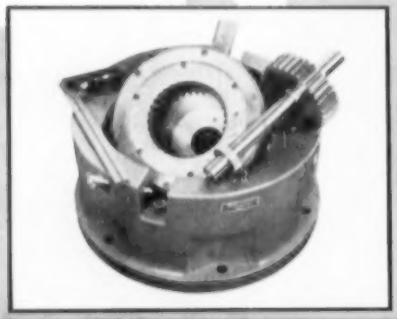
Pitch Line Concentricity Arbors and Chucks

For Automotive and Aircraft Gearing—and all other types of work where Pitch Line Control is required for Production or Inspection Purposes

Engineered for your particular application . . . whether spindle mounted, face plate, between centers, or inspection gauges . . . SPLINEMASTER Arbors and Chucks permit duplicating the same mating condition set up in application of gear train assembly in machining of parts. They also are designed for manual or Draw Bar operation . . . assure three point bearing 100% tooth contact . . . hold gears absolutely rigid from the pitch line; Arbor sizes from point .500 pitch diameter up—smaller sizes for light machining and inspection operations.

Shown here—SPLINEMASTER 180° Indexed Chuck with Aligning Bar, Pitch Line controlled, for use in Aircraft Field. Operation—Grinding Bores on Both Ends and Face.





SPLINEMASTER Arbor, Draw Bar Actuated: For Turning, Facing and Chamfering Operations on Automatic Lathe for part shown here. (Line Pressure 20 Lbs.)

SPLINEMASTER PRODUCTS COMPANY

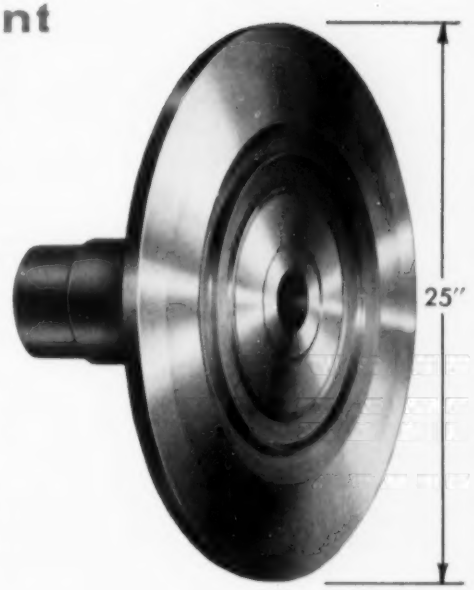
6781 Maxwell • Van Dyke, Mich. • SLocum 7-3400

Detroit Sales Office: TUxedo 4-4270

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-280

℞ — *Fast Cure for BIG Complications . . .*

A SPECIAL P&J Treatment with STANDARD Tools

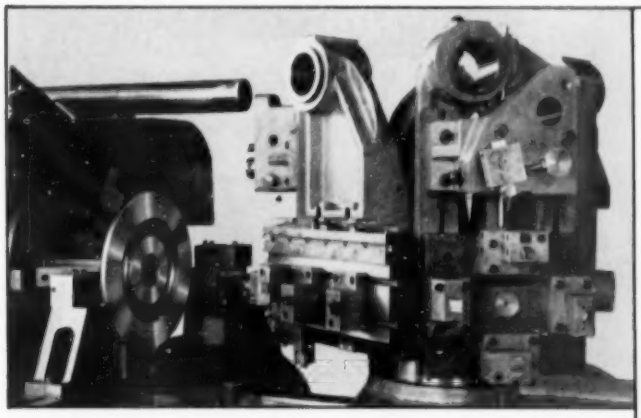


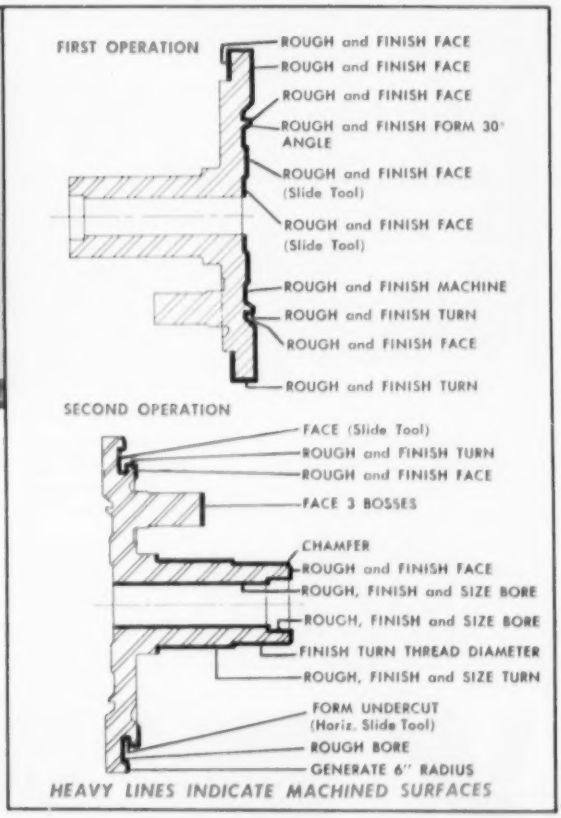
THE PART: A BIG (25-inch diameter) heavy, cast steel Pressure Plate Hub.

THE COMPLICATIONS: 42 separate roughing and finishing cuts involving very heavy stock removal. High accuracy and close concentricity required on *all* machined surfaces, and a fine micro-finish specified for two hub diameters!

THE TREATMENT: Take a big, powerful Potter & Johnston 10-U Automatic; team it with P&J-Engineered Tooling using *STANDARD*, basic tools.

THE RESULTS: Part finished quickly and economically according to specs in just over 47 minutes machining time . . . and tool costs kept to an absolute minimum.




FIRST OPERATION
ROUGH and FINISH FACE
ROUGH and FINISH FACE
ROUGH and FINISH FACE
ROUGH and FINISH FORM 30° ANGLE
ROUGH and FINISH FACE (Slide Tool)
ROUGH and FINISH FACE (Slide Tool)
ROUGH and FINISH MACHINE
ROUGH and FINISH TURN
ROUGH and FINISH FACE
ROUGH and FINISH TURN
SECOND OPERATION
FACE (Slide Tool)
ROUGH and FINISH TURN
ROUGH and FINISH FACE
FACE 3 BOSSES
CHAMFER
ROUGH and FINISH FACE
ROUGH, FINISH and SIZE BORE
ROUGH, FINISH and SIZE BORE
FINISH TURN THREAD DIAMETER
ROUGH, FINISH and SIZE TURN
FORM UNDERCUT (Horiz. Slide Tool)
ROUGH BORE
GENERATE 6″ RADIUS
HEAVY LINES INDICATE MACHINED SURFACES

Performance like this is no exception; it's just one more example of the way a Potter & Johnston Automatic Chucking Turret Lathe can take problem parts in stride. If you're looking for new standards of speed and economy, make it a standard practice to put your complicated jobs on a P&J Automatic with P&J Tooling. In addition to the big 10-U used to machine this massive pressure plate hub, P&J produces a complete line of Automatics for every work size requirement, so send for complete information today.

Write today for complete information . . . or phone the Pratt & Whitney Branch Office near you, and ask a Direct-Factory Representative to call and discuss your requirements. **Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Incorporated).**

POTTER & JOHNSTON

Precision Production Tooling for more than Fifty Years

AUTOMATIC TURRET LATHES • NEWARK GEAR CUTTERS

Check Seals for flatness....

...with **VK** **LIGHT WAVE EQUIPMENT**

Van Keuren Light Wave Equipments, standard gage laboratory equipment everywhere, have long been used for checking gage blocks, toolmaker's flats, comparator anvils and other lapped surfaces in the laboratory or inspection room. In recent years, however, VK Light Wave Equipments and flats have become valuable tools on production inspection jobs. Typical is the growing use of optical flats in checking sealing rings of various materials.

The illustration at right of a sealing ring under a 3" diameter fused quartz optical flat shows how easily measurements can be made. The ring* is acceptable on sight. The bands indicate excellent surface finish (sharp definition of bands), and no warp or low edges (uniform band spacing). Flatness is within .000005" across entire ring, and .000002" across ring face (bands curve less than ½ band interval over entire ring, and 1/6 over ring face).

*Product of Sealol Corp., Providence, R. I.

VK Optical Flat and Seal Ring

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

38th YEAR

THE *Van Keuren* CO.,

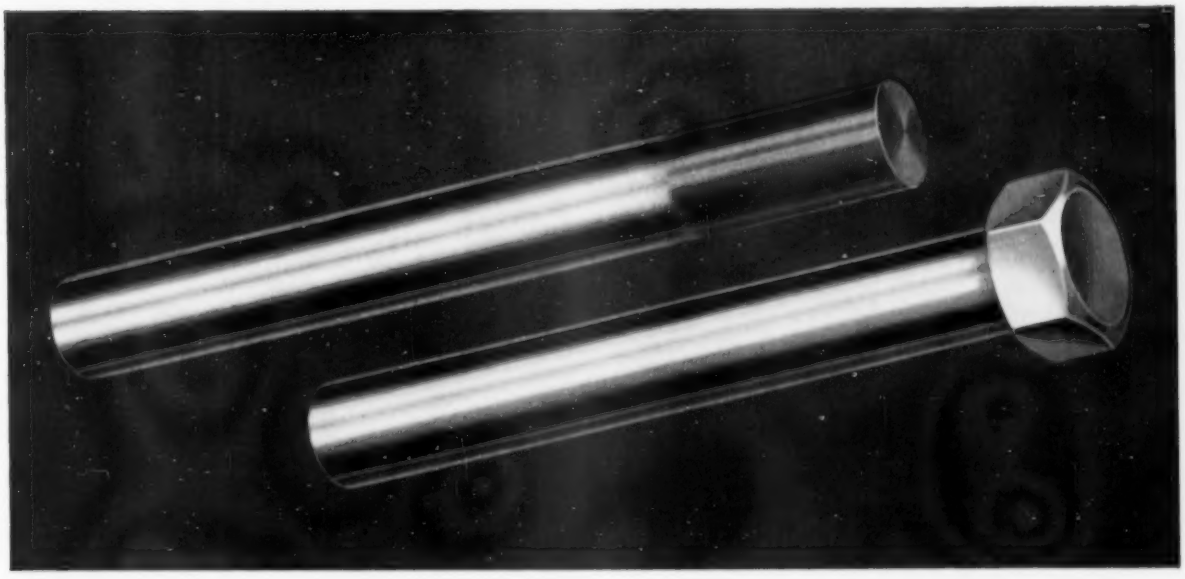
174 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

FORGING: COPPER • BRONZE • ALUMINUM • MONEL AND STAINLESS STEEL

Die Life Increased Up To 400%

with TOCCO* *Induction Heating*



● Naval Bronze, Silicon Bronze, Copper, Aluminum, Monel and all types of stainless steel are heated for forging at the H. M. Harper Co., Morton Grove, Illinois. Regardless of material TOCCO can be profitably applied to brazing, heat-treating and forging operations in almost any metal-working plant.

Production Up—In addition to the very important savings in forging dies, TOCCO has increased production to as much as 265% of output possible with former heating methods. On the 1" type 303 Stainless machine bolt blanks shown here TOCCO upped production from 75 to 200 parts per hour, using 35 K. W., 10,000 cycles.

Versatile—The same TOCCO machine is used on stock of ⅜" to 1¼" diameter; heated zones vary from ½" to 4". TOCCO'S automatic timing cycles provide complete uniformity of heating throughout both length and cross section—assuring a uniformly high quality product.

Why not have a TOCCO Engineer investigate your plant to determine where TOCCO can cut your costs and streamline your production?

THE OHIO CRANKSHAFT COMPANY

Cleveland 5, Ohio

—NEW FREE Bulletin

Cut Inspection Costs

by employing the *added* accuracy and speed of a

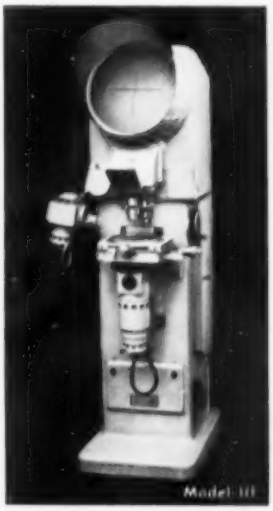
NIKON

Optical Comparator

Permits the study and measurement of surface textures as well as edge contours

A Nikon Optical Comparator permits critical examination of small objects, by projecting their magnified images onto a viewing screen. Because the magnifications are precise, the dimensions of the object can be readily derived from measurements taken of the projected image.

For example, a precise enlarged contour pattern on a translucent sheet, placed onto the viewing screen, can serve to define the tolerance limits of an object or part under inspection. Several critical points can be checked simultaneously. Errors in judgment are virtually eliminated. The most intricate contours, and minute parts, are easily gaged by this technique.



Surface Illumination

One of the important features of the Nikon Optical Comparator is the added facility for surface illumination. This permits the surface topography of any material to be closely examined—for texture, finish, corrosion, wear, etc.

Nikon Optical Comparators are equipped with lens turrets —which permit rapid interchange to selected magnifications—and with fixed adjustment positions for condensers, to provide maximum illumination efficiency at each magnification.

Bright, Even Illumination

Most impressive in the performance of the Nikon Optical Comparators are the extreme accuracy, the overall sharpness of the projected viewing image, and the even brightness of illumination. These are functions of optics, a field in which Nikon has already demonstrated outstanding achievements in the development of new optical glass techniques, photographic lenses, prism binoculars, ophthalmic and other scientific instruments.

Another attractive advantage of the Nikon Optical Comparators is their surprisingly low cost.

Nikon Bench Model Comparators are also available

For specifications and prices, write to: TE-3

NIKON INCORPORATED 251 Fourth Avenue, New York 10, N.Y.

Stereo and Research Microscopes, Surveyor's Transits and other precision optical equipment

USE READER SERVICE CARD; INDICATE A-3-284-1

VAILL

TUBE END-FORMING MACHINES

have hundreds of tube end-forming and shaping applications . . .

Fast, accurate production at less cost.

Beading • Flaring • Flanging • Sinking • Expanding • Grooving • Threading • Reducing • Double Lap Flaring • Double Lap Flanging.

On tubing up to 6 in. diameter.

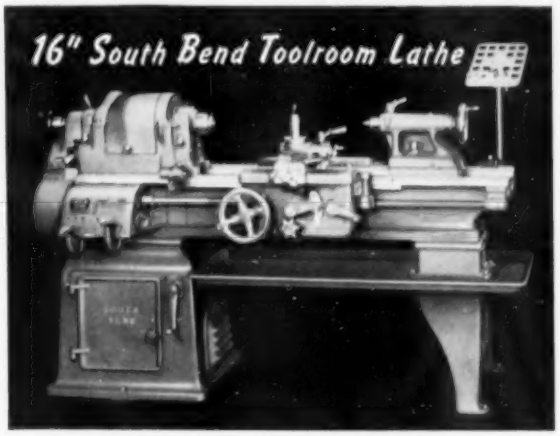
Free—New Bulletin T-1 shows and describes the versatility of Vaill Tube End-Forming Machines.

THE VAILL ENGINEERING CO.

131 E. MAIN ST., WATERBURY 20, CONN.

USE READER SERVICE CARD; INDICATE A-3-284-2

16" South Bend Toolroom Lathe



$2930 16" x 6' Toolroom Lathe less electrical equipment
f.o.b. factory

—A BETTER VALUE

Here is a lathe that will give you maximum return for every dollar invested. Versatile . . . highly accurate . . . easy to operate, it makes difficult close-tolerance jobs easier. Designed for hard industrial use, it will continue to turn out, year after year, the kind of precision work modern tooling demands. And you'll be surprised at the low maintenance cost. Prompt delivery — time payment terms available. Write for catalog.

SOUTH BEND LATHE

SOUTH BEND 22, IND. • *Building Better Tools Since 1906*

USE READER SERVICE CARD; INDICATE A-3-284-3

HELLER

American-Swiss®

ROUND HANDLE

NEEDLE FILES

NEW

a complete set in this compact carrying case

FIRM GRIP HANDLE

For die makers and other fine tool makers. Twelve different shapes, each with long knurled handle for firm grip. All are double cut.

SIZE	CUT	WT.
4"*	0, 2, 4, 6	0-2
5½"	0, 2, 4, 6	0-5
6¼"	0, 2, 4, 6	0-8

*In 4" length, Oval is furnished instead of Crossing.

HELLER TOOL CO. TRADE MARK SINCE 1836

Also made in Square Handle Needle (Escapement) 5½" size only—cuts 0-2-4-6

HELLER
VIXEN® *American-Swiss*® NUCUT®

FAMOUS BRANDS MADE BY **HELLER TOOL CO.**

Subsidiary of Simonds Saw and Steel Co.

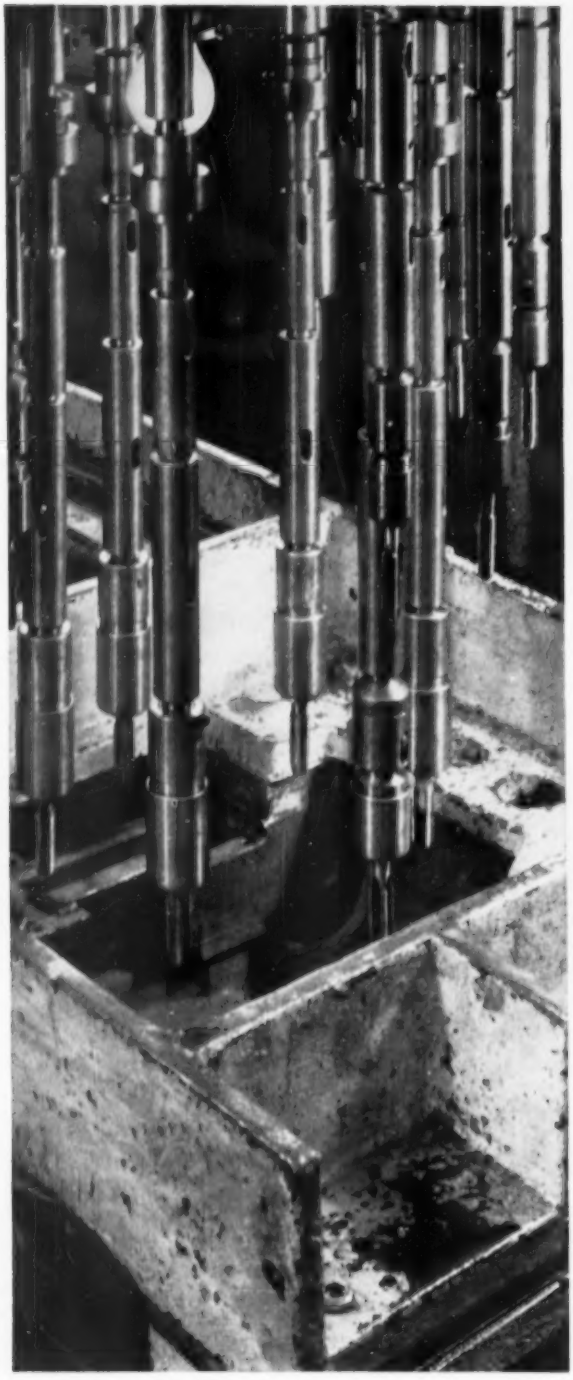
America's Oldest File Manufacturer

BRANCH OFFICES . . . New York • Chicago • Detroit • Los Angeles

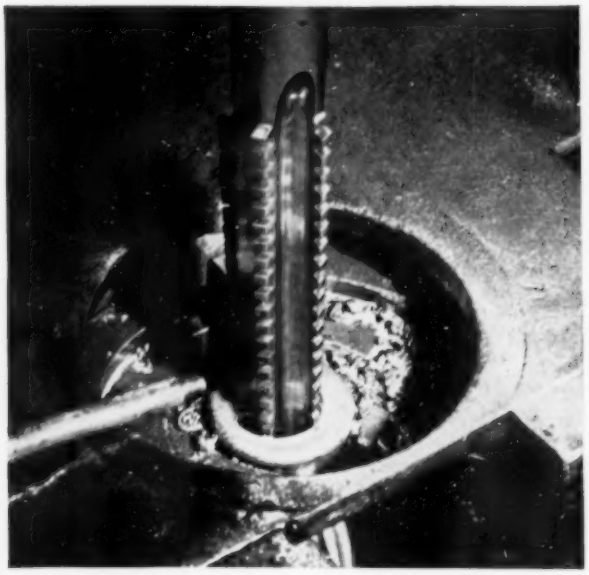
NEWCOMERSTOWN, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-285

Cutting Tool and Gaging



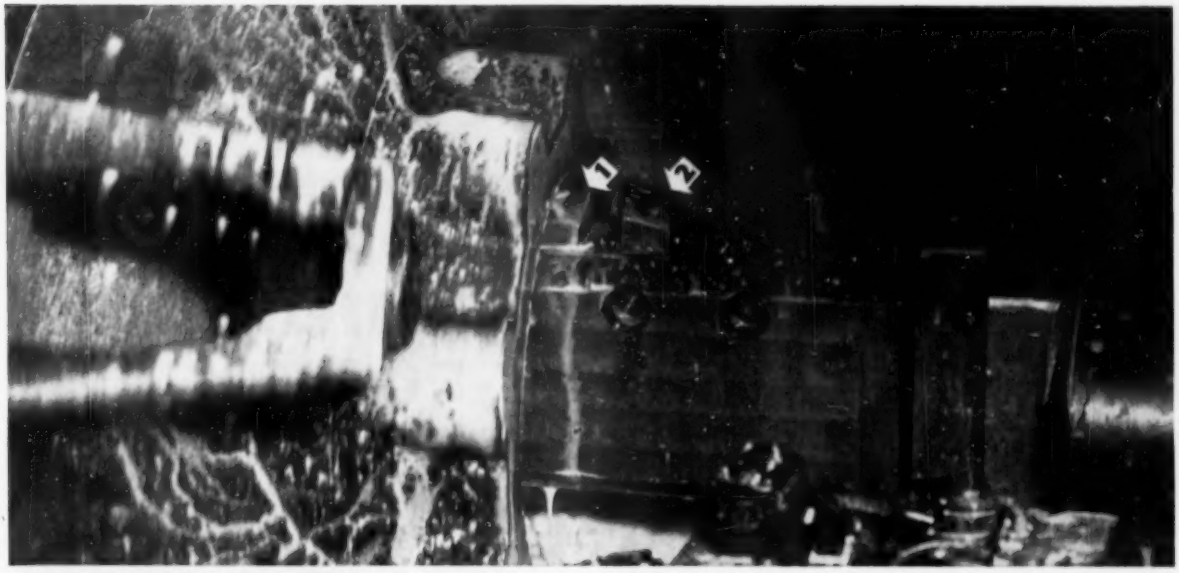
THREADING DEEP—In the production of Massey-Harris tractors at Racine, Wisconsin, Besly Taps prove their accuracy and stamina in tapping tough cast iron—one of the most severe tests of tap quality and endurance. On this automatic machine, equipped with Besly Taps, 16 deep bottoming holes are threaded in tractor frames in one operation. Besly Taps met these exacting specifications with clean-cut, economical threading.



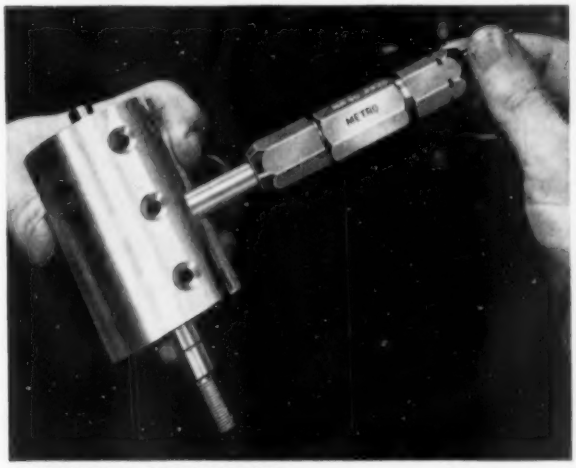
SQUARED OFF—Templeton, Kenly & Company, Broadview, Illinois, cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton capacity screw jacks with Besly acme taps. Notice mirror finish on flutes which promotes greater chip clearance, cleaner cutting. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were matched to the specific workpiece.

MODIFIED TO FIT—The Gabriel Company, Cleveland, requires two concentric tapped holes in die-cast aluminum pistons used in their airplane type shock absorbers. Originally these were tapped individually—requiring 18 seconds per piece. To reduce this time, a unique set-up using Besly Taps was developed. A smaller Besly Tap is fitted inside the bored-out center of the larger Besly Tap. Two holes are now accurately tapped simultaneously in 9 seconds.

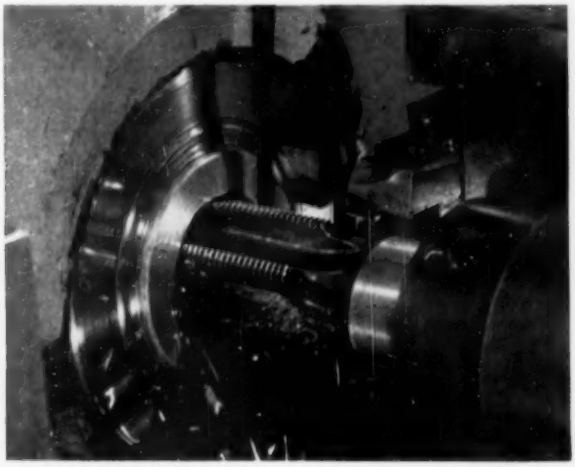
Methods . . . by BESLY



CARBIDE TOOLS IN ACTION — Heavy duty cast steel truck wheels manufactured and machined at Gunnite Foundries, Corp., Rockford, Illinois, are rough bored with a Besly BL-12-B5 Standard Carbide Tipped Tool, removing 1/8" — 3/8" of stock. On the same turret lathe a second Besly AL-12-B5 semi-finish bores, removing .030 stock. Metal removal is at 200 S.F.M. at .016 feed. First tool, arrow 1, is now about one-third through its job. Second tool, arrow 2, is set slightly higher in the same set-up for semi-finishing and follows the first tool. Besly's Engineering Service helped to achieve this set-up with the correct carbide tooling for efficient, low cost metal removal.



ASSURED ACCURACY — To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.



TOUGH GOING — Here you see a C-1018 high carbon steel nut being threaded by a Besly 1¾" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work proved they could take it and were specified by the manufacturer.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials" . . . are a Besly Specialty

BESLY

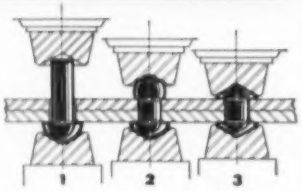
BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
118 Dearborn Ave., South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS

WHY HANNIFIN "HY-POWER" RIVETERS SAVE YOU MONEY

STRONGER JOINTS!

This "silent squeeze" method gives you (1) rapid advance to riveting position, (2) high-pressure shaping of the rivet, cold or hot, and (3) automatic reversal as soon as the rivet is formed. Why are these rivets stronger? Because with this method the rivet shank expands to completely fill the hole and, as the metal flows to shape the heads, fillets are formed under both heads. The rivet is work-hardened, too, and every rivet is uniform.

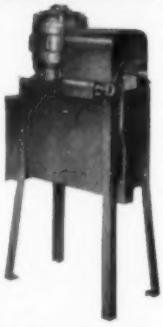


FASTER RIVETING!

Yes! From the time the button is touched it takes only 2½ seconds to head a ⅜" rivet. *"Hy-Power" is safe, too!* For the stroke can be interrupted and the ram reversed automatically anywhere in the cycle, simply by releasing the control button.

QUIETER OPERATION!

Here's the power source for this modern riveting method . . . it's the Hannifin "Hy-Power" Generator. This compact unit is a combination of motor, pump, oil reservoir, automatic control valves and high pressure intensifier that quietly supplies hydraulic pressure to...



...your "Hy-Power" cylinders—available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities (more in multiple). Cylinders can either be mounted in yokes (portable or stationary) or installed in machines of your design.

GET THE FACTS!

Get Bulletin 150. Learn why cost-conscious firms in many fields use "Hy-Power." Just write for your copy of this 32-page book. We'll mail it promptly.

HANNIFIN

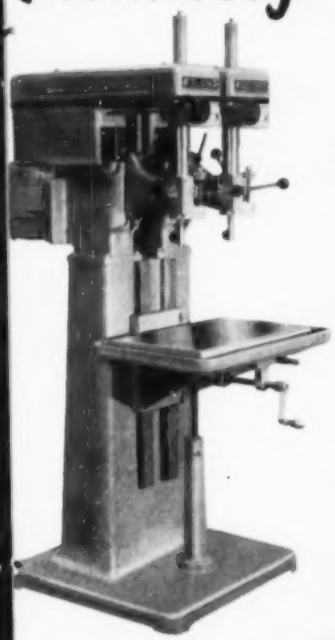
Hannifin Corporation, 519 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

EDLUND

"F" SERIES

Infinitely Variable Speeds



Edlund Model 1F

Sensitive machine for small parts and components.

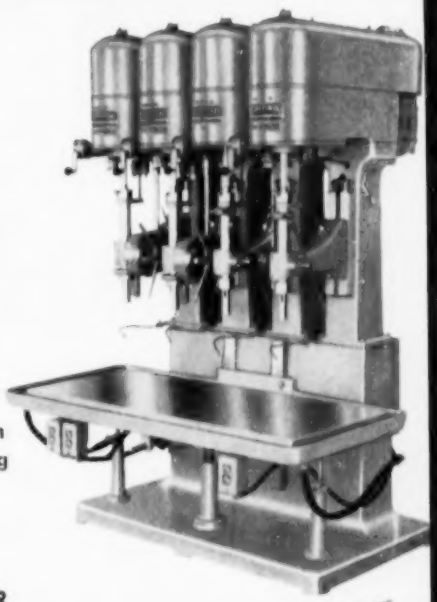
Infinite selection of speeds to 10,000 rpm

7" & 10" Overhang

⅜" Capacity

Pedestal and Bench models

Write for Bulletin 160



Edlund Model 2F

A top production machine for medium to heavy drilling and tapping.

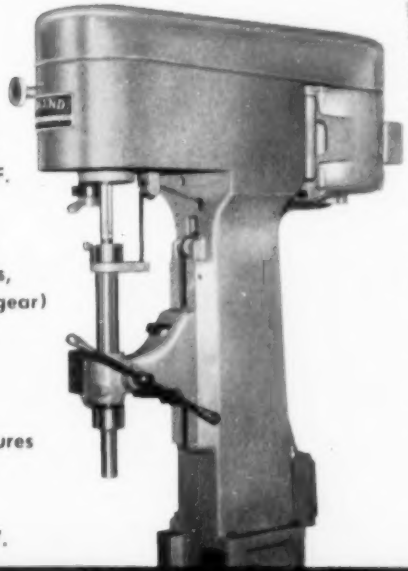
Infinite selection of speeds to 3,600 rpm
8"–12"–15" Overhang
1¼" Capacity

Pedestal and Round Column types

Write for Bulletin 140R

America's Most Versatile Drilling Machines

Introducing....Edlund Model 2FV



Continuous Production Drives for the Model 2F.

If your production requires only one or five pre-selected speeds, (two or ten with back gear) then the 2FV Single or Five-Step Drive will reduce your original machine cost. All other machine features are identical with the Model 2F.

Write for Bulletin 140V.

Edlund Model 4F

A work-horse production machine for heavy duty drilling and tapping operations.

1¾" capacity with infinite selection of speeds to 2200 rpm
12" Overhang

Pedestal or Round Column Types

Write for Bulletin 170 R

EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

EDLUND Representatives in Major Cities

LOW COST GLASS FABRICS

for tooling applications

Trevarno tooling fabrics are specially designed for fast, low-cost manufacture of reinforced plastic tools and dies. They offer these important advantages:

- **Volan AC treatment for fast wetting, higher strength**
- **faster easier layup even on complex jigs**
- **mass-production economy to cut mold costs**

Three basic tooling fabrics are featured: Detail (1P12), General (2P161), and Build Up (2P482). Also available is a complete range of tooling fabrics to meet your individual requirements.

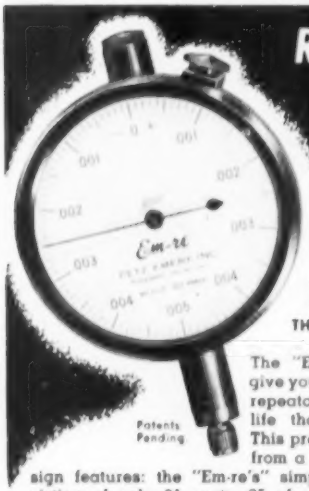
Call or write today for complete literature on quality Trevarno glass fabrics for tooling applications.

COAST MANUFACTURING & SUPPLY COMPANY

P.O. Box 71, Livermore, California • Plants at Livermore, California and Seguin, Texas

Trevarno GLASS FABRICS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-290-1



REPEATED ACCURACY WITH Em-re DIAL INDICATORS

THE MOST ACCURATE MADE

Patents Pending

The "Em-re" Dial Indicator will give you greater accuracy, greater repeatability and longer service-life than ever before possible. This precision performance results from a unique combination of design features: the "Em-re's" simple, unit construction consisting of only 31 parts, 25 of which are interchangeable and common to all models — a fully jeweled gearing mechanism — and a completely shockproof system, throughout the *entire* range, that *actually contributes to* the measuring accuracy obtained. Rigid testing with millions of severe impacts has failed to impair even slightly this repeated accuracy (to better than .00002" in .00005" and .0001" indicators). Stocked in 26 models, 9 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". *Also available for accurate indicator testing — The "Master" Dial Indicator Checker.*

Write for Catalog D.

PETZ-EMERY INC.

PLEASANT VALLEY, NEW YORK

USE READER SERVICE CARD; INDICATE A-3-290-2

Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch grams
...inch ounces
...inch pounds
...foot pounds

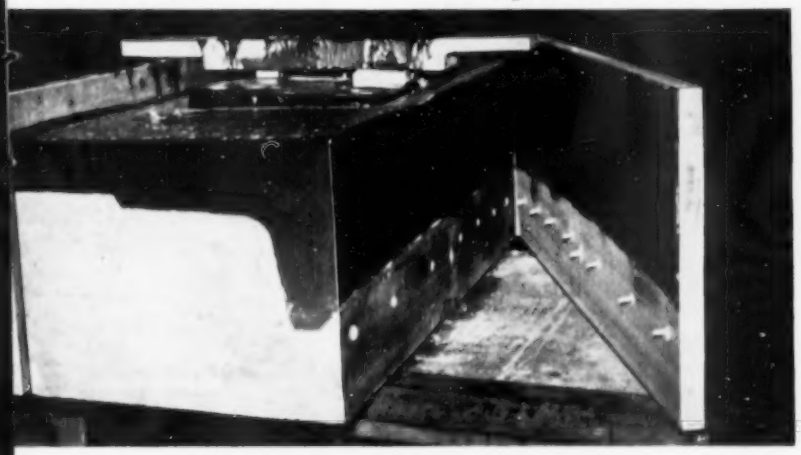
Every manufacturer, design and production man should have this valuable data. Sent upon request.

PA STURTEVANT CO.
ADDISON QUALITY ILLINOIS

USE READER SERVICE CARD; INDICATE A-3-290-3

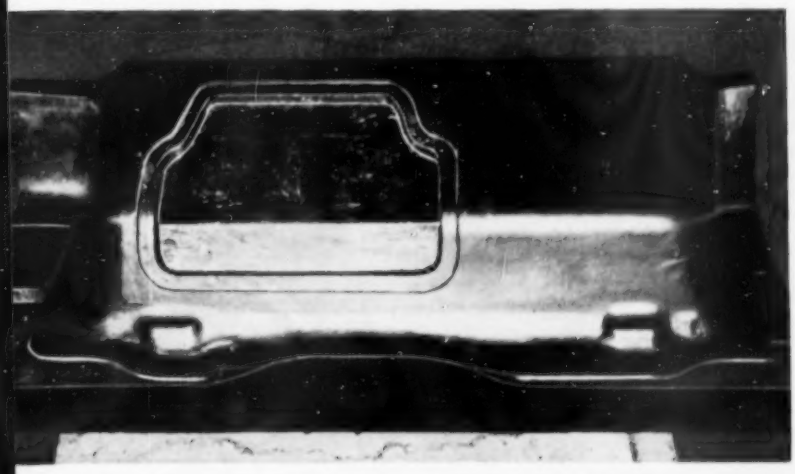
1. Sprayed lacquer seals plaster female mold, taken from a male master model. Next, mold will be waxed and buffed before parting agent is applied. Wood frame forms sides of mold.

2. Mixture of epoxy tooling compound and hardener is poured into mold. Light gray block is a plastic foam core suspended in mold to become part of finished tool, lessening weight and cost.



3. Compound hardens completely overnight at room temperature, 70-85 deg. F. Frame is removed, showing tool as dark area. Plaster mold, coated with parting agent, is easily separated.

4. Virtual absence of shrinkage eliminates "barbering." This epoxy hammer form is ready to use. Making plaster mold, drying, sealing, pouring compound and curing took less than 24 hours.



Metalworking plastic tool in 24 hours!

(and two men can lift it!)

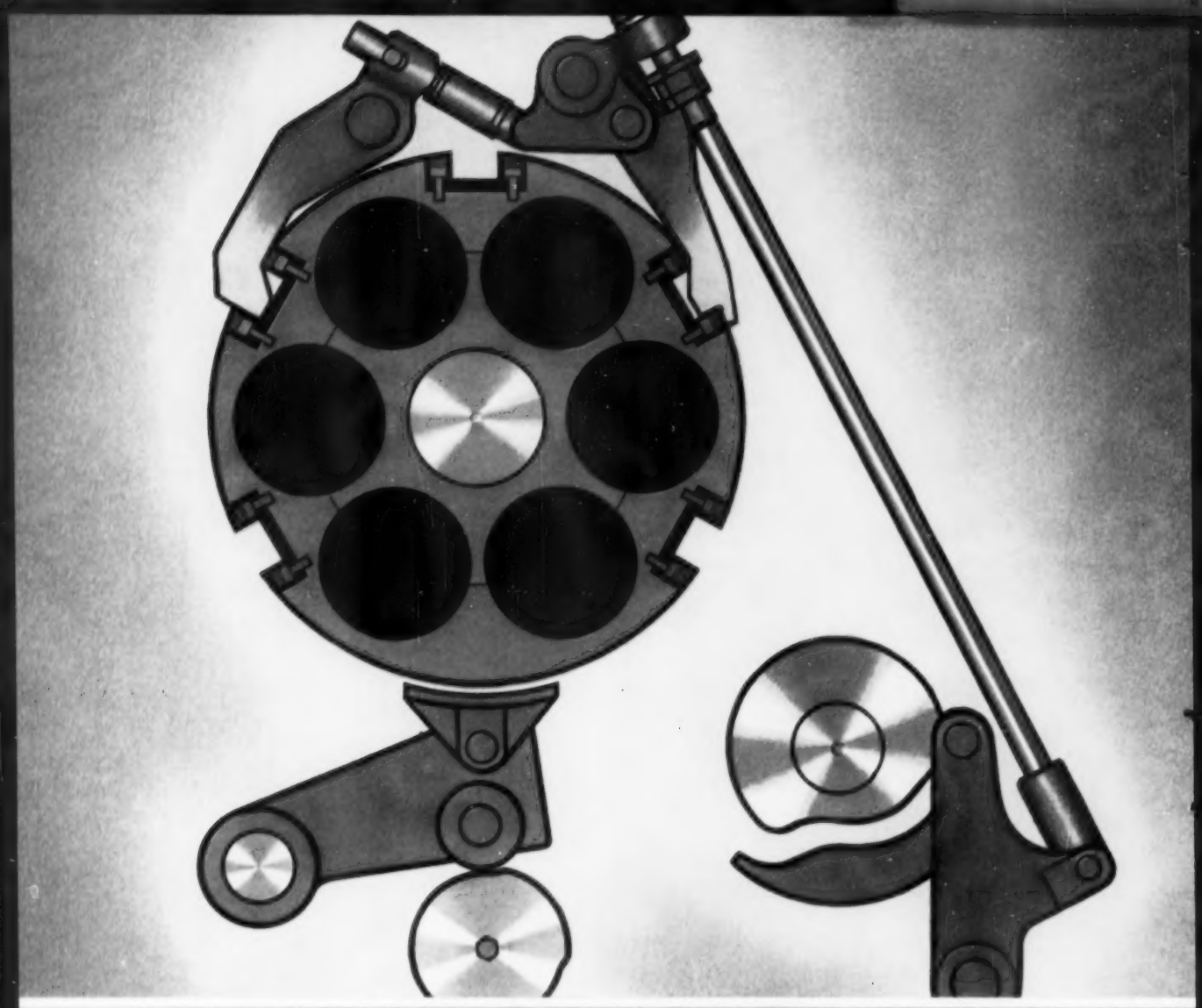
This lightweight plastic hand hammer form was made in one day. It is typical of the metal-working tools being made from compounds based on BAKELITE Brand Epoxy Resins. Prototypes, stretch plugs, draw dies, and hydroform blocks are others that share the same advantages. They are quickly and simply produced, can be altered or modified at low cost by machining or adding more compound, and are so light that two men can handle a tool that, in metal, would call for power lifting equipment. Make your own tests now. For information and a list of formulators, write Dept. WE-181.

Tooling by Creative Industries, Detroit, Mich., from compounds by **Marblette Corp.**, L. I. C., N. Y., based on BAKELITE Epoxy Resins.

BAKELITE
BRAND
EPOXY RESINS

BAKELITE COMPANY
A Division of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario.

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.



heavier, faster cuts

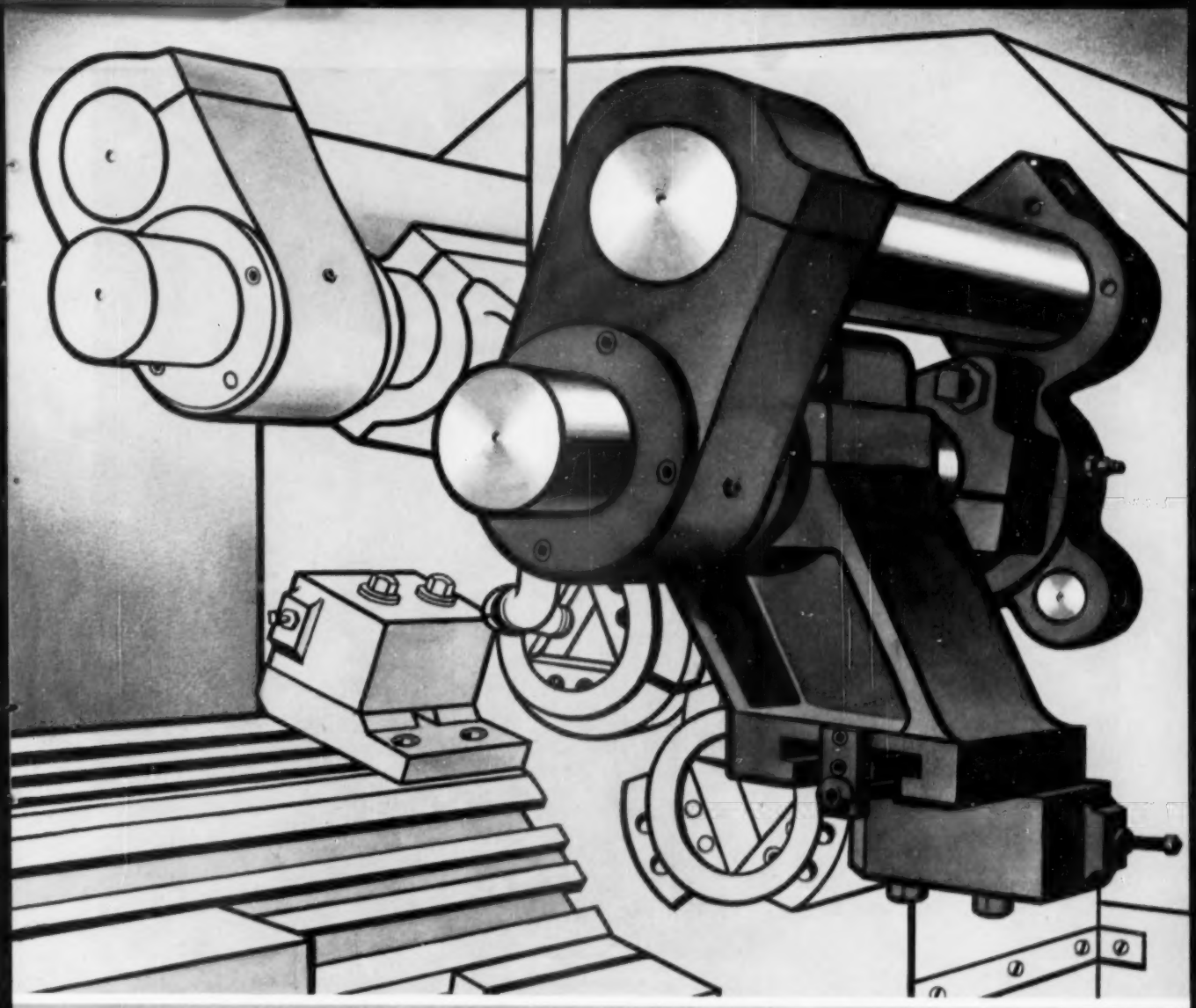
with accuracy

This cross section of a New Britain spindle carrier illustrates three features that assure permanent accuracy under today's constant heavy duty use.

1. Positive, accurate location of the carrier means perfect spindle alignment with the tool.
2. Rigid clamping of the carrier makes it integral with the frame during the cutting cycle, eliminating carrier weave and vibration.
3. Automatic spindle carrier lifting mechanism eliminates all wear during indexing, and so guarantees preservation of initial accuracy.

Features like these don't show on the surface — you "see" them in the form of continued accurate production, year after year. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Automatic Bar Machine
NB



3 money-making advantages

from 1 exclusive New Britain feature

New Britain's exclusive swinging arms can do everything a cross slide can do, *and*:

- You can position them for any length piece.
- You can turn O.D.'s and I.D.'s and faces with single point tools.
- You can *combine* transverse and longitudinal motions to turn tapers or radii and do recess boring.

Before you invest in automatics, check New Britains. Their "do more" principles can produce a greater return — often it's the difference between a single machining and the need for secondary operations. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.

Automatic
Chucking Machine

NB

Partners in Top Performance!

CARMET

TOOL HOLDERS AND THROW-AWAY INSERTS

Write for your copy:

Carmet Tool Holders and Throw-Away Inserts

12 page catalog containing specifications of Carmet tool holders and inserts. Also data on replacement part kits for tool holders and other necessary information.

ADDRESS DEPT. TE-87

You can keep your production lines rolling and your operating costs low when you combine good equipment with an efficient tooling program. *Carmet tool holders and throw-away inserts fill the bill on both counts!*

Carmet tool holders permit quick, accurate indexing of blanks to a new cutting edge . . . or complete exchange of one blank for another . . . without dismantling tool setup. Grinding is eliminated, and machine downtime is reduced to practically nothing.

Carmet tool holders are cadmium plated to resist corrosion and chip erosion. They can accommodate either ⅛″ or 3/16″ thick blanks. Improved clamp screw eliminates need for special wrench . . . is accessible from both top and bottom of tool holder. Carmet inserts are permanently marked for positive grade identification assuring you the right blank for the right job.

There are over 90 styles and sizes of Carmet tool holders to choose from and 20 sizes of Carmet throw-away inserts available in six different grades . . . either utility or precision ground. Convenient Replacement Part Kits also available to service every style of Carmet tool holder.

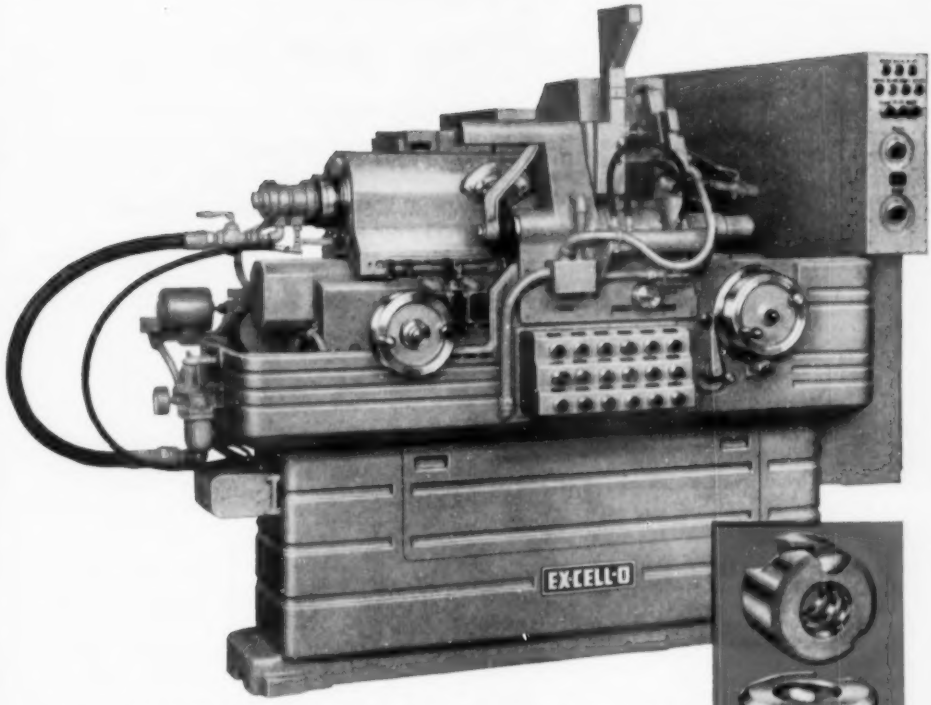
Check your nearest A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.*

For ALL your CARBIDE needs, call

Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

WBW 6413



Ex-Cell-O Style 39-A Precision Internal Thread Grinder equipped with automatic work handling equipment. This machine loads, locates, grinds threads and ejects steering gear ball nuts in a completely automatic cycle.

Short Runs, High Production, or Automation with Ex-Cell-O Thread Grinders

These standard machines are grinding thread gages, machine tool lead screws, innumerable aircraft parts, automotive steering mechanisms and pinions, worms, taps, and many similar workpieces.

Precision thread grinders in this Ex-Cell-O line range from manually-operated models, for toolroom and for short runs, to high production automatics, to styles equipped with automatic work handling equipment. There are five models designed to meet your every requirement.

For specific information, call your local Ex-Cell-O representative.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-4

EX-CELL-O STYLE 33 FOR EXTERNAL THREADS: An accurate production machine, automatic except for loading, unloading, and moving the cycle lever. Can be arranged for tapered grinding and for eccentric relief grinding.

EX-CELL-O STYLE 36 FOR LONG EXTERNAL THREADS, also available with internal attachment. A high production machine with easily adjusted work cycles.

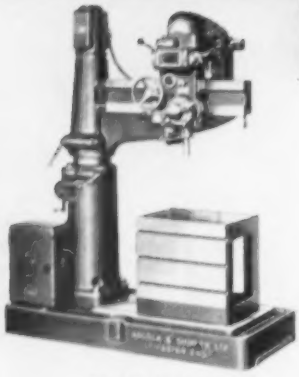
EX-CELL-O STYLE 50: A versatile machine for external work . . . also available with internal attachment.

EX-CELL-O STYLE 120: Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

XLO
EX-CELL-O for PRECISION

ADCOCK and SHIPLEY

HIGH PRODUCTION MACHINE TOOLS
Maintain Accuracy Consistently

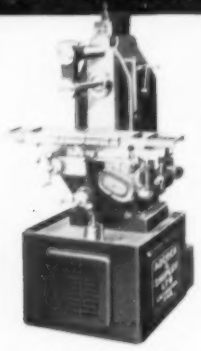


36" High Speed

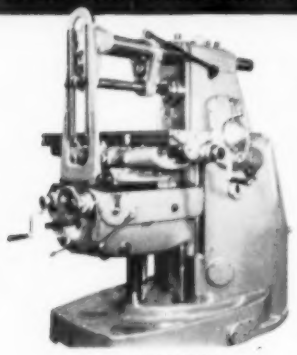
RADIAL DRILLING AND TAPPING MACHINE

- Hand or power elevating 9" column.
- Finger light controls reduce operator fatigue.
- Tapping reverse electrically operated by lever on saddle is standard equipment on all machines.

MILLING MACHINES FROM THE LARGEST TO THE SMALLEST . . . WITH TABLE SIZES FROM 12" X 5" TO 72" X 17"



Models 1AD and 2D
Automatic cycle millers give rapid approach, set rate of feed and rapid return to starting position. Independent mechanically operated feed box eliminates complicated hydraulics and electronics, keeping maintenance costs to a minimum.



Model 2JUR
Table size: 50" x 10"
5 or 7½ H.P. motor drive

Model 4HG
Table size: 72" x 17"
Powerful 25 H.P. motor drive

Power and automatic rapid traverse in all directions. Positive backlash eliminator with hardened table screw. Precision ground Meehanite tables.

Complete line of HORIZONTAL, UNIVERSAL and VERTICAL milling machines
Also manufacturers of optical lense-grinding and glass working machines
Write for literature and prices TODAY!

STANLEY SHEPPARD • U.S. Representatives • 30 Church St., New York 7, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-296-1

HOW TO HAVE *Fewer Rejects*

On tapping and reaming jobs, when rejects result from the work being slightly out of alignment with the spindle, the remedy is to use a Ziegler Floating Tool Holder.

Unlike ordinary tool holders, the Ziegler requires alignment only within 1/32" of accuracy on the radius (or 1/16" on the diameter) to enable the machine to do a perfect job. Try it and see!

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-3-296-2

The New SCHERR MICRO-PROJECTOR with the VERTICAL design

NEW 1957 SELF CONTAINED IMPROVED MODEL FEATURING

- ✓RIGID FLOOR BASE - ELIMINATING EXTRA CHARGE FOR TABLE
- ✓TILTING STAGE FOR HELIX, ANGLES AND BEVELS
- ✓4" DIA. STAGE OPENING
- ✓COLUMN SLIDE ADJUSTABLE FOR WEAR BY MEANS OF GIBS - WILL HOLD SQUARE INDEFINITELY.
- ✓CUSTOM MADE PRECISION COATED LENSES & DOUBLE CONDENSERS FOR DIFFERENT OBJECTIVES 10 TO 100X MAGNIFICATION.
- ✓AN ENTIRELY NEW PRACTICAL DESIGNED TOOL FOR INSPECTION DEPARTMENT AND PRODUCTION SHOP.

WRITE FOR ILLUSTRATED FOLDER

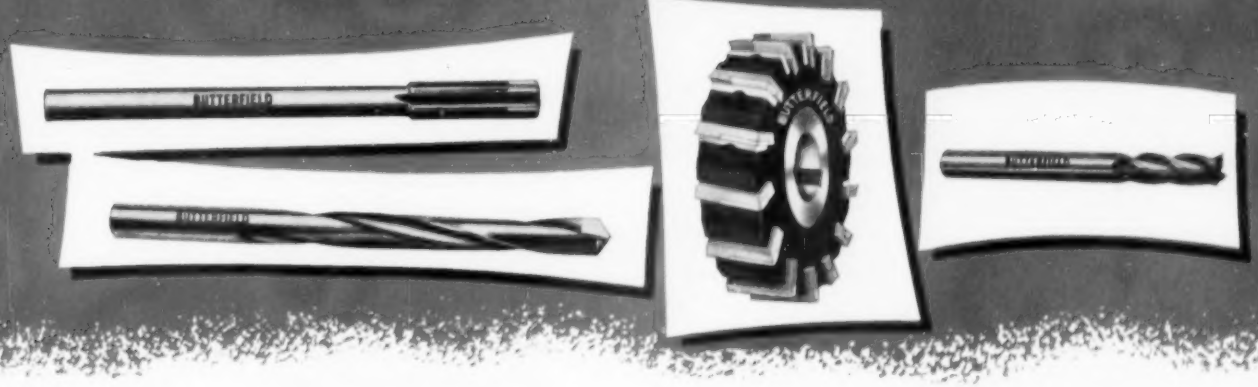
GEO. SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-TE LAFAYETTE STREET • NEW YORK 12, N. Y.

USE READER SERVICE CARD; INDICATE A-3-296-3

Guarantee TOP Performance and Maximum Life!

100% BUTTERFIELD

Carbide Cutting Tools



100% COMPLETE LINE . . . EVERY TOOL 100% INSPECTED . . . AND YOU GET

100% SERVICE FROM YOUR BUTTERFIELD DISTRIBUTOR

Butterfield also offers a complete line of taps, dies, drills, reamers, cutters, end mills and hobs. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. **BUTTERFIELD DIVISION** • Union Twist Drill Company • **Derby Line, Vermont.**

WITH

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS

On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS

On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from −100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

Specify TEFLON HYDRAULIC ROD SEALS

On all Hydraulic Cylinders

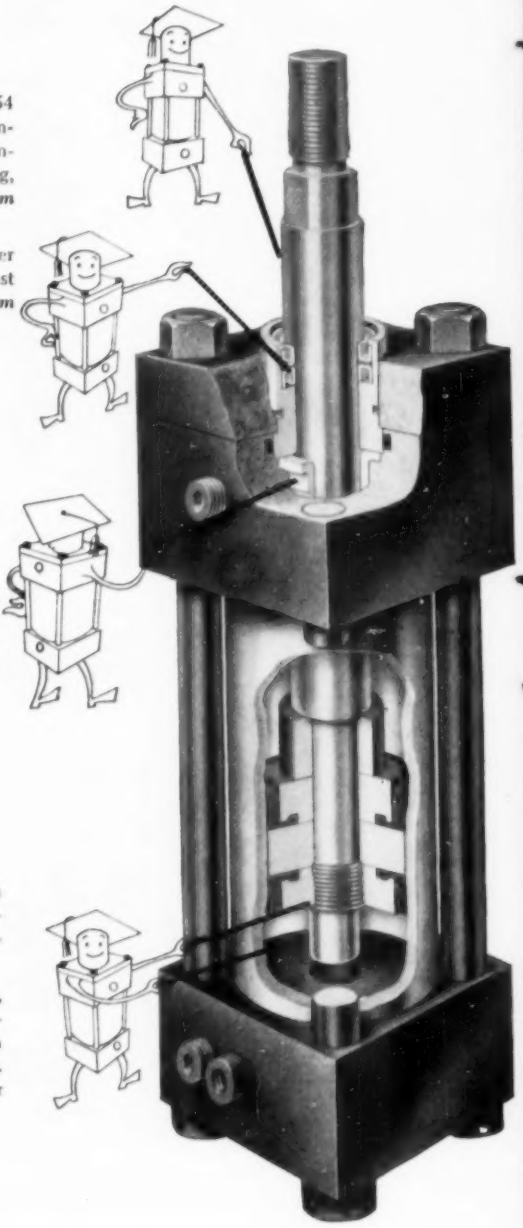
Specify RUST RESISTANT SURFACES

On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



NOTE: On all Miller Hydraulic Piston Seals: Leather Cup Seals are *standard*, Piston Ring Seals are optional at *no extra cost* and "Teflon" Cup Seals are available *at extra cost*.

You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.) _____

"On all our future cylinder requirements, please specify the above quality features."

Signed _____

Title _____

Member of the National Fluid Power Association

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY
BUFFALO • ROCHESTER • MINNEAPOLIS • GRAND RAPIDS • DETROIT • FLINT
FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE
KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE
DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • ATLANTA
TORONTO, CANADA and OTHER AREAS

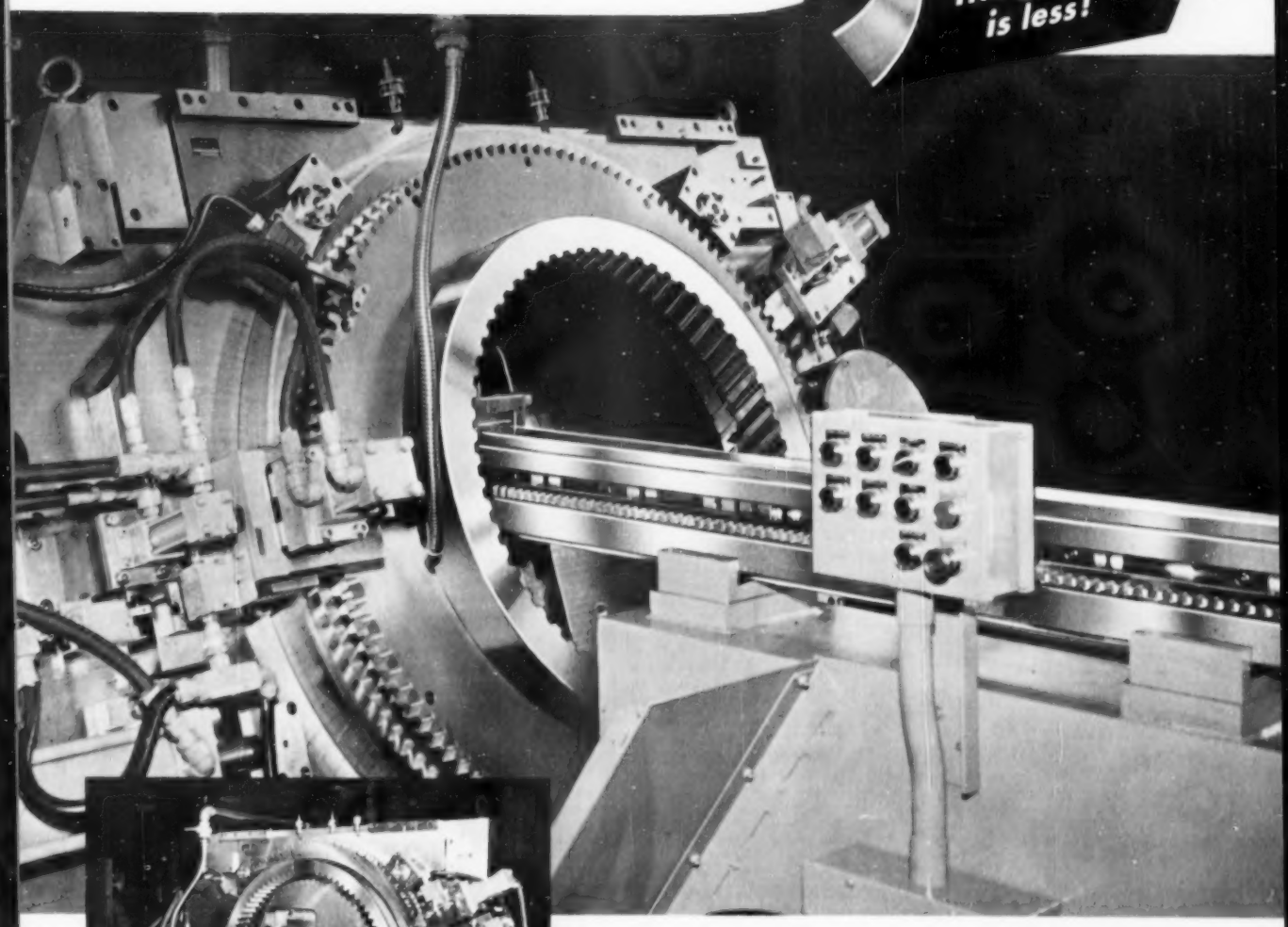
Miller

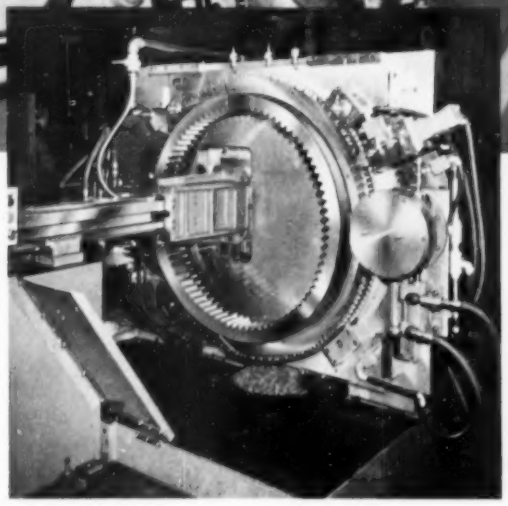
MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

WITH COLONIALS the final cost is less!





Using automatic shuttle and automatic index, a standard COLONIAL universal horizontal machine broaches a line of huge gears, spur and semi-finished helical in two passes per tooth (two sizes and types of the gears are shown in these photos). Length of cut is 4½ inches. The machine is a 15-ton, 90-inch stroke, described in our Bulletin HAS-52. Ask us for a copy.

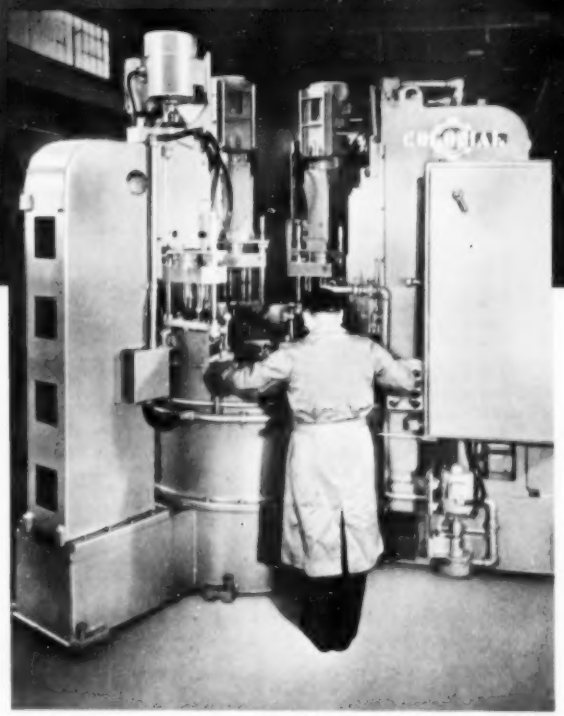
Broaching Grader Gear Cuts All-day Job to Hour and Half

When roadbuilding equipment producers want higher output at lower cost, they turn to **COLONIAL.** Your parts are probably unlike this big steering gear—one of three types and sizes turned out on the same machine. We can't promise the same savings, but you might get even more. In case after case, **COLONIAL** unified broaching offers the lowest cost per piece produced. Are you getting BROACHING NEWS regularly? If not, drop us a line.

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

WITH COLONIALS the final cost is less!

304/hr



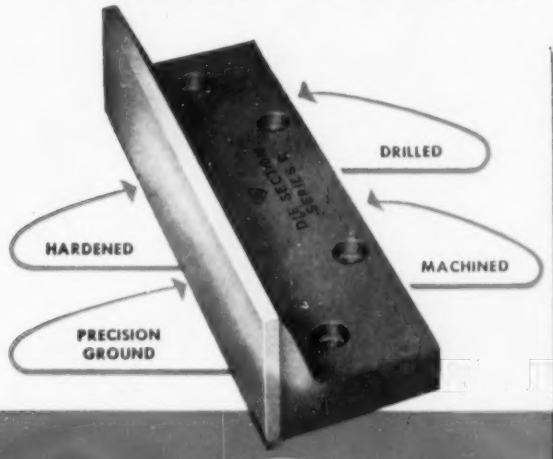
This COLONIAL 6-station machine performs 14 operations on each of two pawls in a cycle time of 18 seconds, including loading. Operational sequence is: drill four holes to half depth; drill through; chamfer all holes both sides; ream; broach four different surfaces in one pass. Index alignment is to within 0.0005 inches.

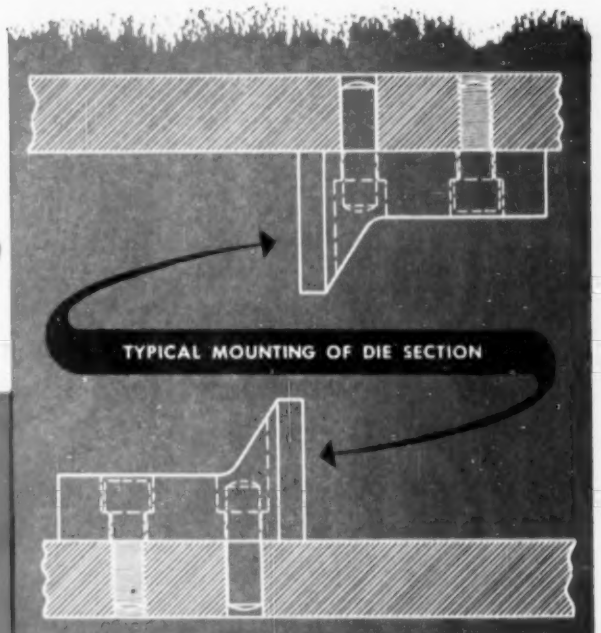
COLONIAL Multi-Stations Now Integrate Broaching with Other Operations

COLONIALS new multi-station machines now make possible complete integration of broaching with drilling, chamfering, reaming, etc., for reduced handling, high output, accuracy and low cost. All basic machine components for the various operations are standard and combined to most effectively meet the needs of automative, aircraft and other industrial parts producers in machining current designs.

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

Reduce Your Die Building Time...





Standardized Die Sections

Standardized Die Sections manufactured by R-B eliminate all of your machining, drilling, hardening and grinding. For, these die sections are entirely prefabricated and ready for mounting on your die shoes . . . they will substantially reduce your die building time.

Series A, B & C die sections have cutting edges of tool steel which are hardened and precision ground. Bases are of mild steel to permit drilling of dowel pin holes.

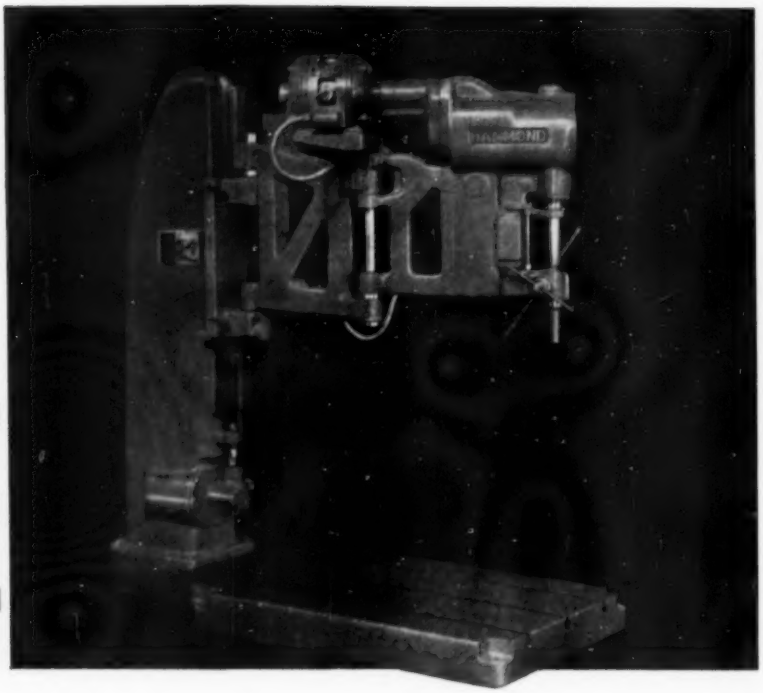
Series AA, BB & CC die sections are not hardened, have wider lands and are of the same general construction as series A, B & C. These extra wide lands permit contouring before hardening. Die sections in both series are available in various lengths and heights.

TOOL STANDARDIZATION is the basis for saving production time. With R-B you get the accepted standard of the sheet metal industry—in standard design features that save in engineering, die construction and operation.

Use R-B Engineering Service for Your Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 89 • 26490 CAPITOL AVENUE • DETROIT 39, MICHIGAN

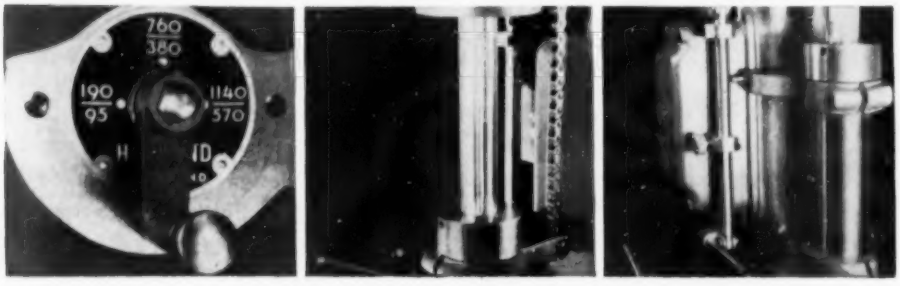
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT



for *faster* radial drilling and tapping

■ Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • **Cleveland 8, Ohio** • Detroit Office: General Motors Building



Engineered for production

FOOTBURT

MACHINE TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-302

THIS IS RIDICULOUS...

No one but a photographer ever saw a die set as shiny-bright as this one. If it's not being worked on in the tool room, usually it's buried away in a punch press, covered with oil and dirt, banging out piece after piece day after day.

And each one of those pieces is just like the others within a few thousandths of an inch. That's precision, the secret behind the success of mass production.

That's the reason for the die set's existence—to aid in maintaining precision just as long as possible. To do that, it has to be precision built.

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Factory-assembled and factory-inspected, Detroit die sets meet the most important requirement of a die set, precision, in their parallelism, squareness and finish. High-quality materials plus more than ample size maintain that precision.

Over 2000 standard, stock die sets are detailed in Detroit Die Set's new catalog. Details on specials and accessories, too. Ask for it on company letterhead, or call your local representative.

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

MULTI-FLEX

A Versatile Line of Boots, Connectors, Bellows, Tubes, Air Ducts

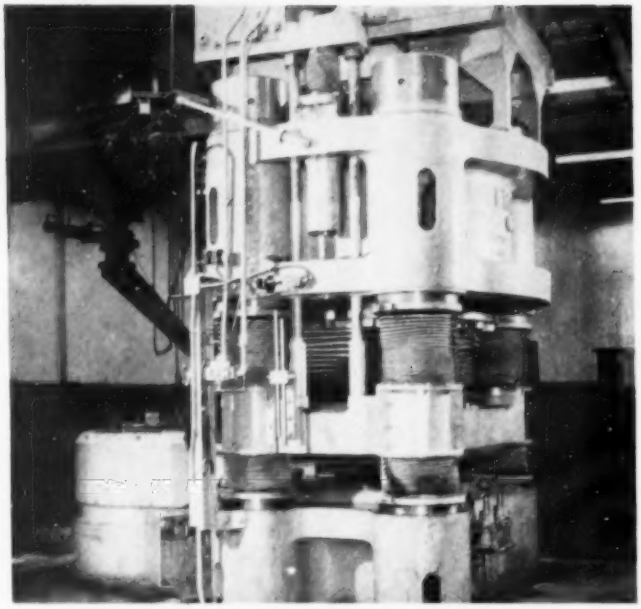
If the equipment you make requires

- accordion protective boots
- connectors to take bends or movements in compression or extension
- bellows to move air or be actuated by air
- extremely flexible tubing that will not kink

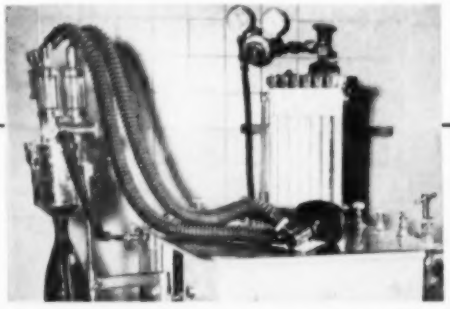
you'll do well to investigate U.S. Multi-Flex.®

Made circumferentially corrugated without molds or other tooling, in inside diameters ranging from ¼" to 48", and engineered to your particular requirements, these products may furnish the answer to difficult-to-solve application problems.

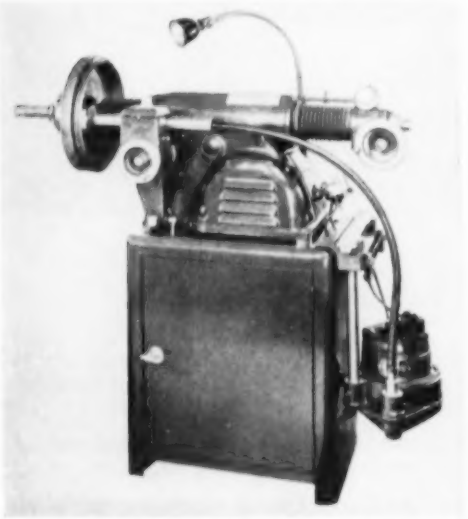
Get U.S. Multi-Flex, plus expert engineering service, at any of the 28 "U.S." District Sales Offices, at selected distributors, or by writing us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



Multi-Flex laced boots keep dirt and grit out of hydraulic rams. They are laced for easy installation without dismantling press.



Multi-Flex conductive tube—extra-flexible and lightweight—in use on anesthesia equipment.

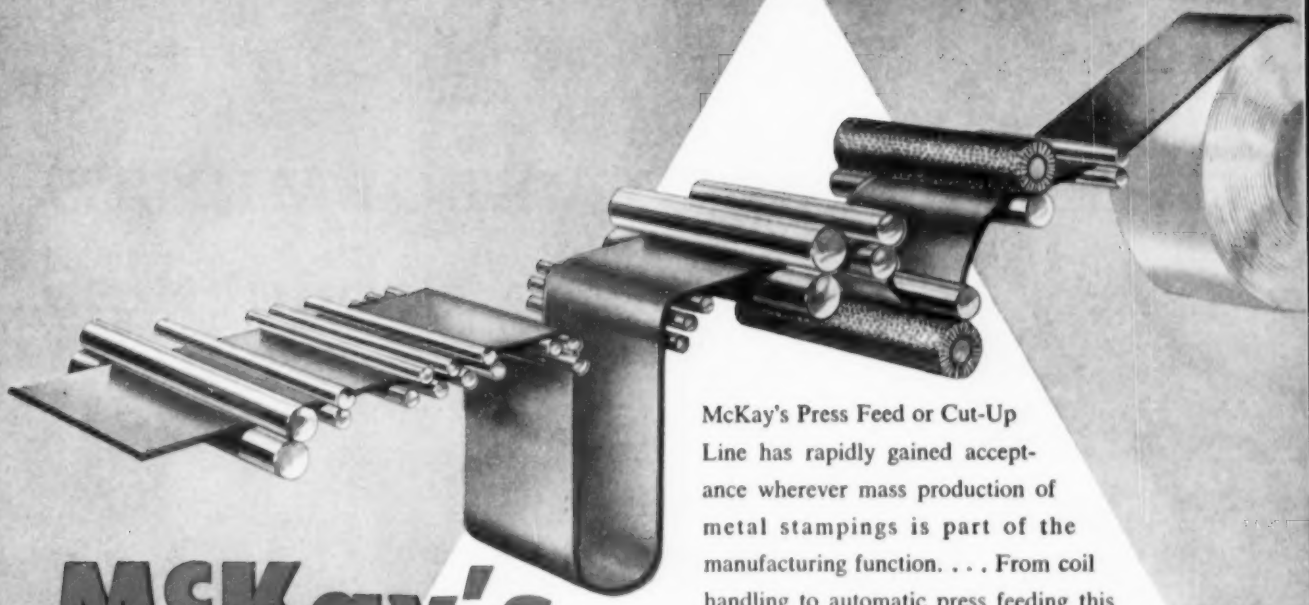


Multi-Flex boots giving constant protection to the shaft on this brake drum lathe.

Multi-Flex connectors on vacuum filter, taking care of axial movement and misalignment.

Mechanical Goods Division

United States Rubber



McKay's
PRESS FEED LINE

McKay's Press Feed or Cut-Up Line has rapidly gained acceptance wherever mass production of metal stampings is part of the manufacturing function. . . . From coil handling to automatic press feeding this line is the most successful yet developed. It uncoils, cleans, conditions and precisely measures the steel swiftly and economically. McKay engineers will show you one of these modern lines in operation at your earliest convenience.

THE McKAY MACHINE COMPANY
Youngstown, Ohio

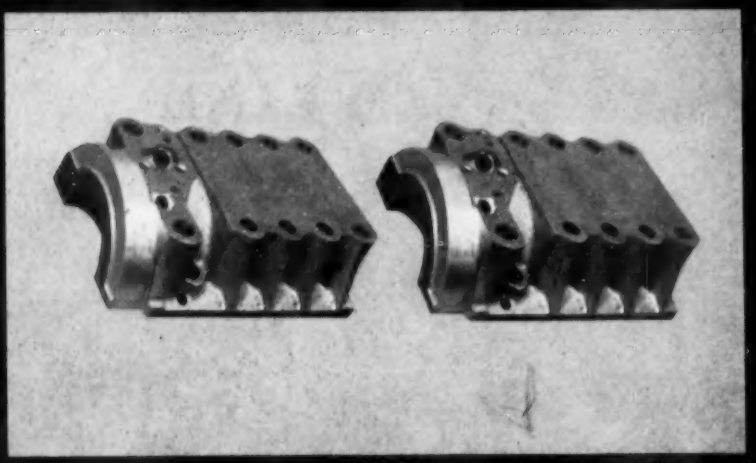
McK

SETTING THE STANDARDS OF QUALITY METAL WORKING MACHINES FOR TWO GENERATIONS

10037

THREE NEW DEVELOPMENTS
Increase Production

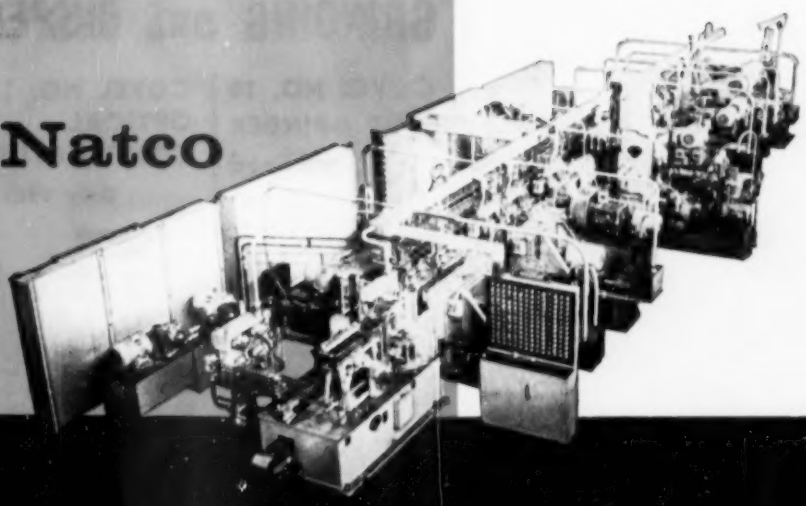
2-at-a-time processing



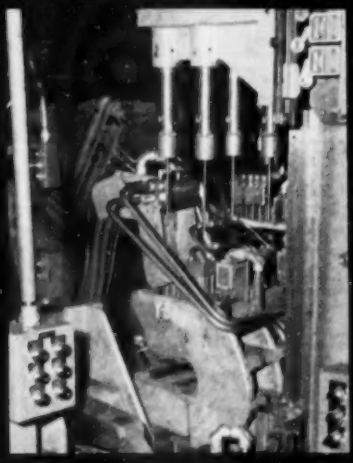
300 HP Natco greatly increases production by processing two complete sets of bearing caps at once.

Bearing caps—240 *sets* per hour—six times the production rate of the machine replaced! This new Natco processes two complete sets at once. It loads surface-broached castings automatically, performs 80 machining operations, places matched sets of finished bearing caps on the assembly conveyor. In addition to broaching and sawing, this 300 HP, 27-station Natco, drills, reams taps, turns, mills, probes and faces.

help this Natco 600%

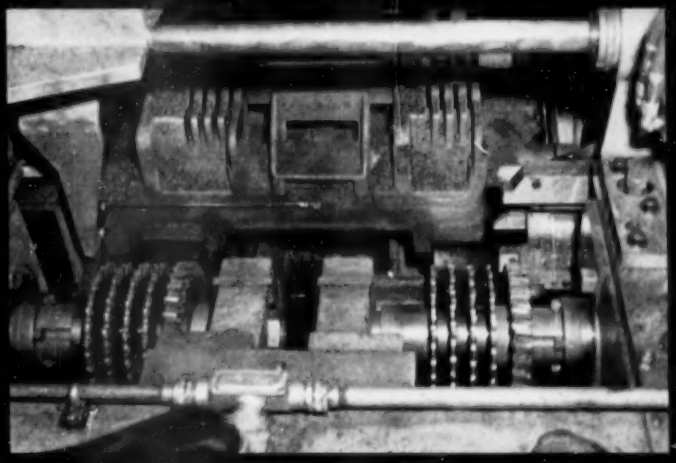


Unique Broaching Station



Fully automatic broaching station eliminates need for withdrawing broaching tools after cut. Broaching tools are pulled completely through hole, removing .030" stock.

New Rigid Saw Station



80 HP sawing station cuts two castings into complete sets of 5 caps each. All surfaces parallel within .0015". Fixture feeds castings into stationary mounted saws, providing rigidity for accurate 14 ipm cutting.

Whatever your high production problem, our engineers will work closely with your people to develop exactly the method and the machine to do your job best. Besides special way-type, index and transfer machines, Natco also builds multiple drilling, boring, facing and tapping machines. Call your nearest Natco office in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

Partners in Production

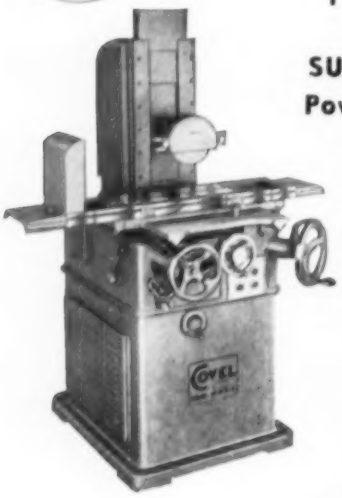
NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC. *Richmond, Ind.*

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan

COVEL

COMBINATION CUTS GRINDING and INSPECTION COSTS!



COVEL NO. 10 SURFACE GRINDER
Power or Hand Feed

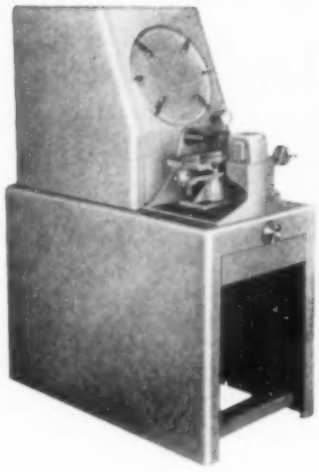
Work Capacity—6" x 18" x 15"
Grinding Wheel—7" x ½" x 1¼"

This Covel machine offers a big value at a low price. Gives you these big machine performance features:

- Elevating, traverse feed, and table feed hand wheels grouped at convenient waist level position.
- Hard chrome table ways.
- Smooth timing belt table drive.
- Precision hardened and ground vertical and traverse feed screws.
- Extra engineered weight.

Write for Bulletin TE 27-10

COVEL NO. 14 OPTICAL COMPARATOR
Only $985.00



For fast, accurate optical inspection

Add modern, efficient optical gaging and inspection at a price you can afford. Outmodes mechanical checking methods, prevents costly errors, saves time and money. The Covel Optical Comparator is easy to use. Grinding machine operator can be quickly trained to check his own work right on the job. Large 14" diameter screen is easy to read in fully lighted room. Horizontal stage travel 6". Rugged, precision construction throughout.

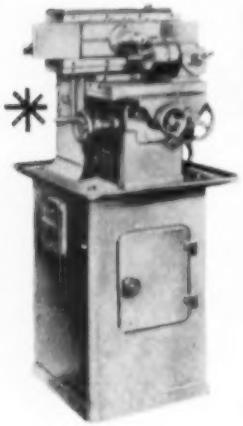
Write for Bulletin TE 27-14

Covel offers the widest choice in Surface Grinders up to 14" x 24". Cutter and Tool Grinders. Drill Grinders. Optical Comparators.

COVEL | PRECISION GRINDERS
Benton Harbor, Michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-308-1

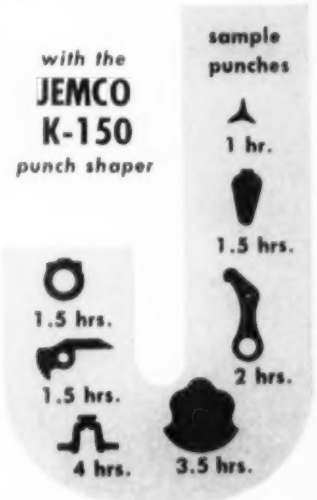
FORM and PUNCH SHAPER



ECONOMICAL PUNCHES with CURVED NECKS finished completely IN ONE CHUCKING

with the
JEMCO K-150
punch shaper

sample punches



- finish job in one chucking
- 30 power built-in microscope for high precision — close tolerances

EXCLUSIVE TERRITORIES OPEN
write for complete information to . . .

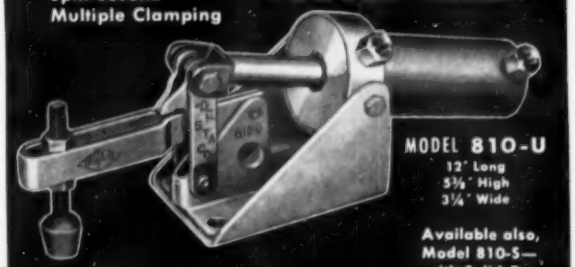
Jersey manufacturing co.
401-E LIVINGSTON ST. • ELIZABETH, N. J.

USE READER SERVICE CARD; INDICATE A-3-308-2

presenting...the NEW

DE-STA-CO **Clamp-Omatic**
AIR OPERATED
TOGGLE CLAMP

for Positive Split-Second Multiple Clamping



MODEL 810-U
12" Long
5⅛" High
3¼" Wide

Available also, Model 810-S—with Solid Bar

- MORE RUGGED
- MORE COMPACT
- MORE VERSATILE
- LONGER LASTING

Holding Pressure to 750 Pounds with Normal Air Line Pressure of 90 Pounds. Weight 4 lbs. 4 oz.

Write today for Literature on these NEW DE-STA-CO CLAMP-OMATICS—Models 810-U and 810-S

DE-STA-CO **DETROIT STAMPING COMPANY**
WORLD'S FIRST LINE OF TOGGLE CLAMPS
328 Midland Avenue • Detroit 3, Michigan

USE READER SERVICE CARD; INDICATE A-3-308-3

faster delivery

FROM YOUR LOCAL INDUSTRIAL DISTRIBUTOR'S STOCK

ACME Dowel Pins

- Standard PINS available in lengths from 3/8" to 6"—1/8" to 1" in diameter. Specials, including pins of stainless steel, quoted on request
- Precision pins, hardened and ground to .0002" or .001" over nominal diameter—also available: .002", .003", .004" and .005" oversize—all diameters .0001"
- Acme Pins are case hardened to 60-62 Rockwell "C" scale and a core hardness of 36-38
- Acme Pins will break before bending or mushrooming

Write for information and prices on standard and oversize dowel pins

ACME INDUSTRIAL COMPANY

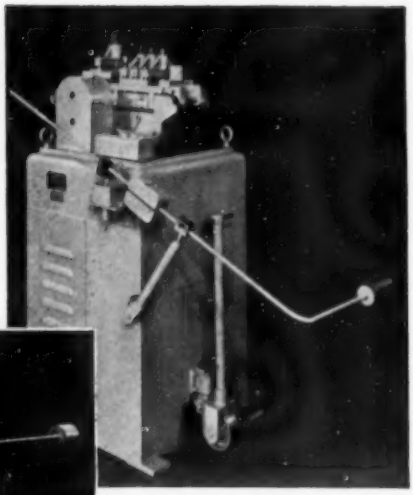
208 N. Laflin Street • Chicago 7, Illinois • MOnroe 6-4122

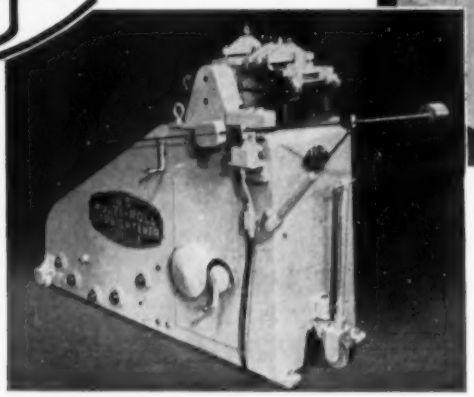
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-309

USE U.S. PRODUCTS ★

REDUCE PRESS ROOM COSTS

Right: Model PDS-4½ U. S. Power Driven Straightener (portable type) for material up to 4½" wide, ¼" thick. Equipped with ½ HP variable speed drive motor. Also made in other sizes.



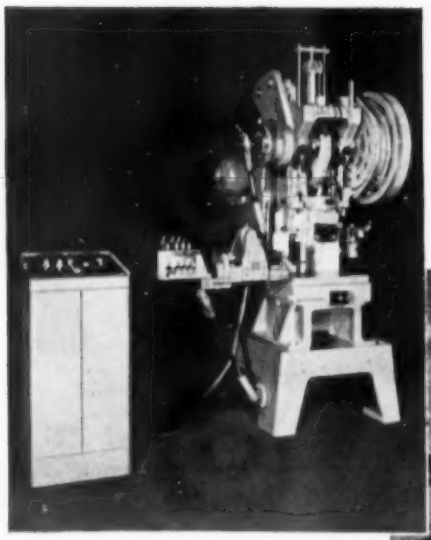


Left: Model PDS-940 U. S. Combination Coil Cradle and Power Driven Straightener (portable type) for material up to 9" wide, ⅛" thick, coils with OD up to 40". Includes 2 HP variable speed drive motor. Also made in other sizes.

Don't allow inefficient operations to devour your profit margin. U.S. Automatic Press Room Equipment is designed and built to help you effect savings in the production of stampings.

The use of coil stock in your punch press operations should result in very definite savings, and these savings can only be completely assured by using automatic equipment in conjunction with your presses. The illustrations show just a few of the many different units included in the U.S. line for the efficient feeding, straightening and holding of coil stock.

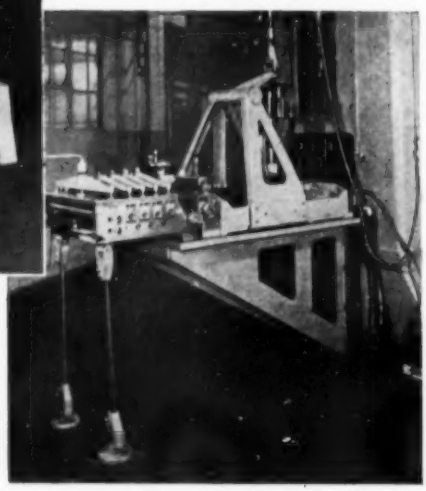
Investigate to see if you are effecting all the cost reductions possible. Ask for a copy of Bulletin 80-T.



Above: Model SF-12 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 4½" wide. Shown mounted on a Minster B1-32 High Speed Gap Press.

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) **NEW JERSEY**



★ **U. S. PRODUCTS**

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
Multi-Slides ®
Multi-Millers ®

Left: Model SF-24-24 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 24" wide. Shown mounted on a Straight Side Press.

...and in taps and in gages CARD is ACES with OPERATORS

"Card taps and gages are action-mated to the job," are the words actual operators use to describe why they are precise and accurate. Tool after tool . . . shipment after shipment . . . the Card Product is exactly what the operator expected it to be. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

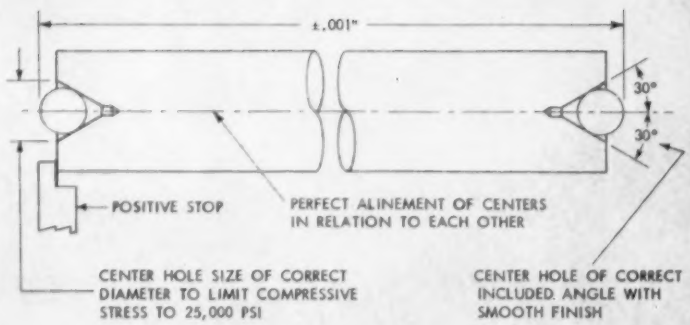
CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through fine distributors from Coast to Coast

CENTERING IS CRITICAL

FOR TRACER AND AUTOMATIC LATHE PRODUCTION


±.001"
30°
30°
POSITIVE STOP
PERFECT ALINEMENT OF CENTERS IN RELATION TO EACH OTHER
CENTER HOLE SIZE OF CORRECT DIAMETER TO LIMIT COMPRESSIVE STRESS TO 25,000 PSI
CENTER HOLE OF CORRECT INCLUDED ANGLE WITH SMOOTH FINISH

The above sketch graphically highlights the centering "musts" for work to be automatically machined between centers.

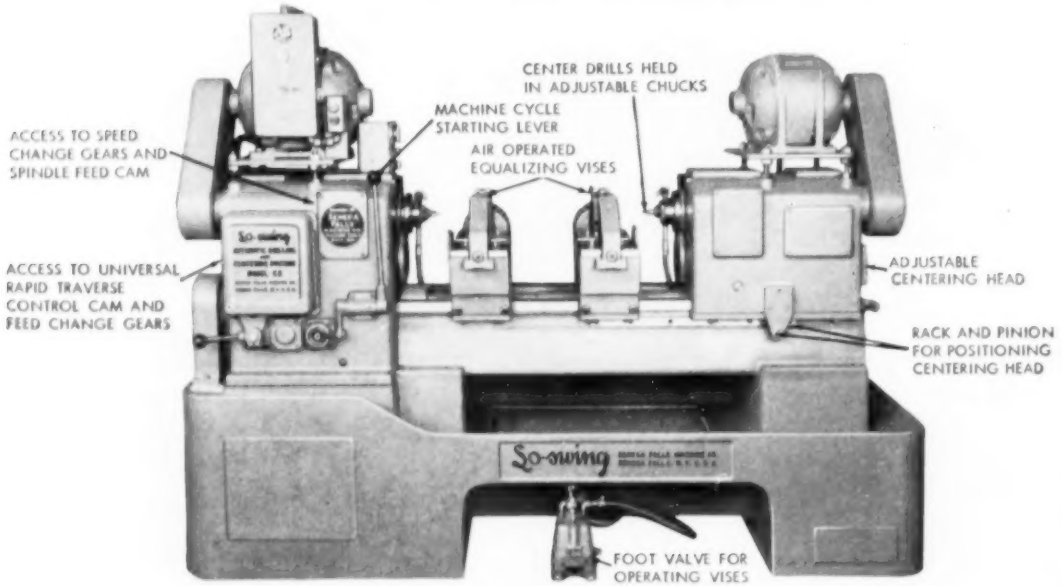
Model CS Lo-swing Automatic Drilling and Centering Machine has the inbuilt features to provide all these requisites. It is designed for accurate centering on a continuous, high production basis, yet can be quickly and easily "changed-over" for short run jobs. Its 100% mechanical system provides positive, independent control of rapid traverse movements and drilling feeds. It has a fully automatic cycle and can be completely automated in a production line.

Write for your copy of Bulletin CS-54 which tells the whole story.

THIS IS WHAT MODEL CS WILL DO TO CUT COSTS ON TRACER AND AUTOMATIC LATHE PRODUCTION

- provide positive control of center depth to ± .001".
- accurately locate work piece to assure correct center depth at *both* ends.
- guarantee correct angle and perfect alinement of center holes.
- produce a smooth, cleanly-finished center hole capable of positive contact with the surface of the center. This is accomplished by a unique design of the feed cam which withdraws the center drill near the end of the feed stroke to clear chips . . . and then feeds a few thousandths at reduced rate for a final finish cut.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.


CENTER DRILLS HELD IN ADJUSTABLE CHUCKS
MACHINE CYCLE STARTING LEVER
AIR OPERATED EQUALIZING VISES
ACCESS TO SPEED CHANGE GEARS AND SPINDLE FEED CAM
ACCESS TO UNIVERSAL RAPID TRAVERSE CONTROL CAM AND FEED CHANGE GEARS
ADJUSTABLE CENTERING HEAD
RACK AND PINION FOR POSITIONING CENTERING HEAD
Lo-swing
FOOT VALVE FOR OPERATING VISES

Lo-swing MODEL CS AUTOMATIC CENTERING MACHINE

IT'S NICE...
TO BE SURE OF YOUR
BEARINGS!

QUALITY
EXPERIENCE
DEPENDABILITY
PRICE
QUALITY
EXPERIENCE

Write for Catalog No. 150

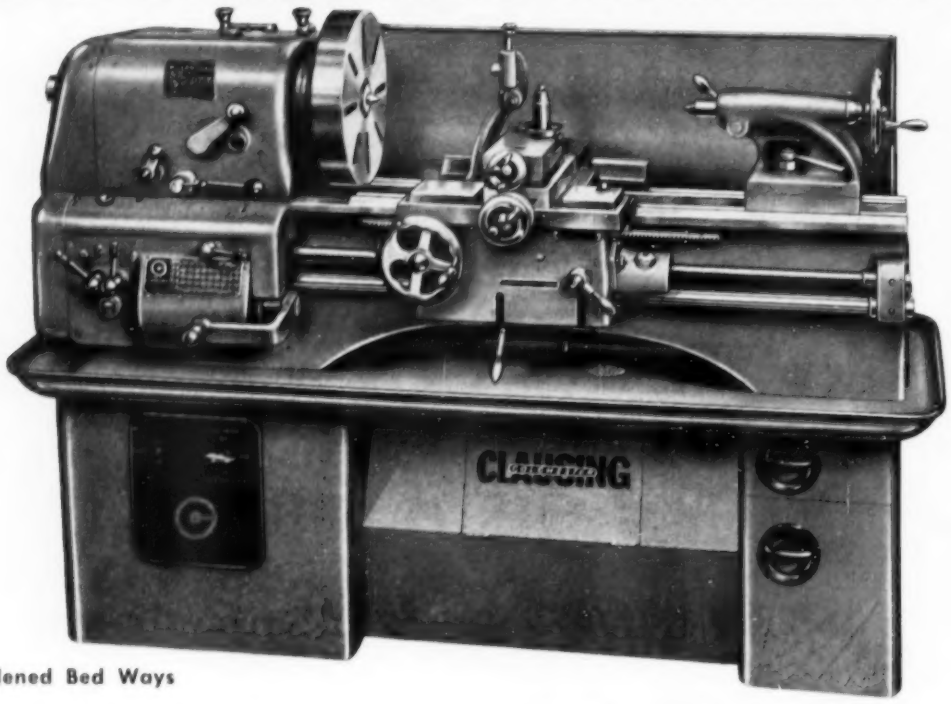
NICE

NICE BALL BEARING CO.

NICETOWN • PHILADELPHIA • PENNSYLVANIA

See how much MORE you get with... CLAUSING COLCHESTER

13"-15"-17" GEARED-HEAD PRECISION LATHES



Hardened Bed Ways

BIG CAPACITY—larger spindle capacities (see chart below). Swing for the gap bed models is 28" for the 17"; 24" for the 15"; and 18" for the 13". Between centers capacities: 78" for the 17" lathe; 30" and 48" for the 15"; and 24" and 36" for the 13". Geared-head drive powered by multiple V-belts.

CAPACITY	17"	15"	13"
THRU-HOLE	3 1/16"	2 1/16"	1 9/16"
NOSE TAPER KEY DRIVE	L-2	L-1	L-0

HEAVY-DUTY CONSTRUCTION — Massive semi-steel beds with elliptical cross ribbing. Induction hardened, precision-ground V and flat bed ways. Geared-head and quick-change box run in bath of oil, all gears shaved and hardened. Power feeds taken from separate feed rod, lead screw used only for screw cutting. Note heavy-duty construction of tailstock, and of carriage assembly with double-walled apron.

PRECISION PERFORMANCE—built to American toolroom lathe standards of accuracy. Have GAMET MICRON tapered roller bearings . . . with oil flow lubrication . . . most advanced and accurate bearings known to industry.

PROMPT DELIVERIES — through your authorized CLAUSING-COLCHESTER dealer.

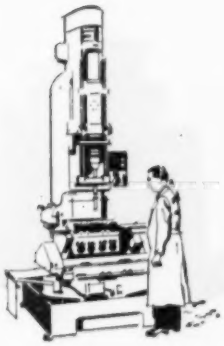
OUTSTANDING QUALITY and VALUE — Clausing-Colchester lathes are acknowledged the world over to be the finest value and the most accurate in their class!

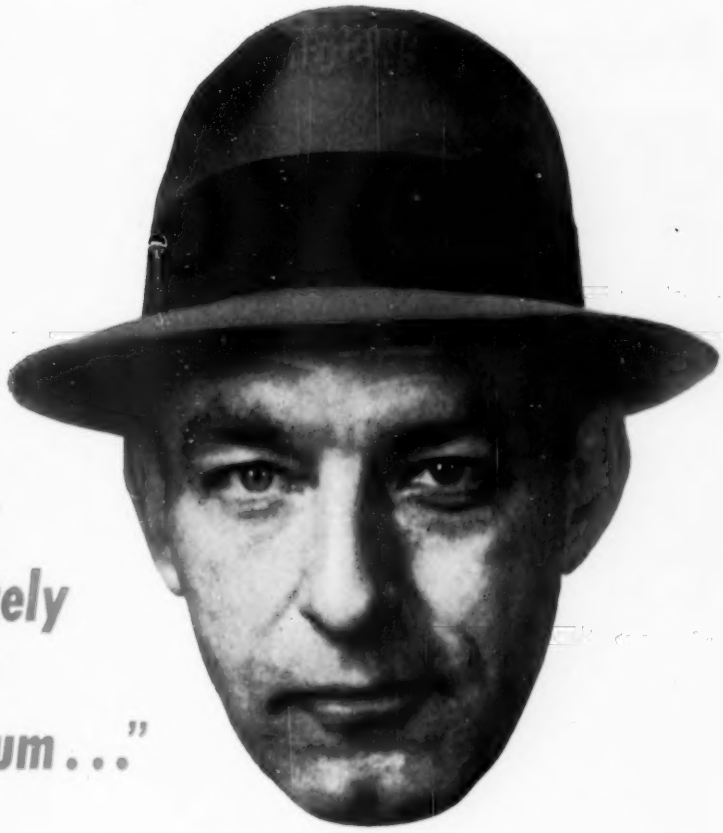
PRICES — 13" cabinet base models, including motor and controls, start at $1952; 15" cabinet base, illustrated, at $2744; 17" model at $4345. 5 straight bed and 6 gap bed models available, with choice of one or two speed motors.

WRITE FOR ILLUSTRATED LITERATURE

CLAUSING COLCHESTER

CLAUSING DIVISION
ATLAS PRESS COMPANY
3-114 N. PITCHER ST. — KALAMAZOO, MICHIGAN





"TRUKUT® completely eliminated gum and scum . . ."

A large manufacturer of mold bases had a problem with grinding coolants. The grinding oil mist was causing a heavy gummy scum to form on the machines and floors.

Sinclair Representative J. H. Schindler was called in to help solve the problem. Mr. Schindler reports: "I knew from actual experience that Sinclair TRUKUT EP Soluble Oil, Grade C, would give good wheel life and fine finishes without gum or scum. I submitted a 5-gallon sample for test. After changing to Sinclair's grinding coolant, the gum and scum were completely eliminated.

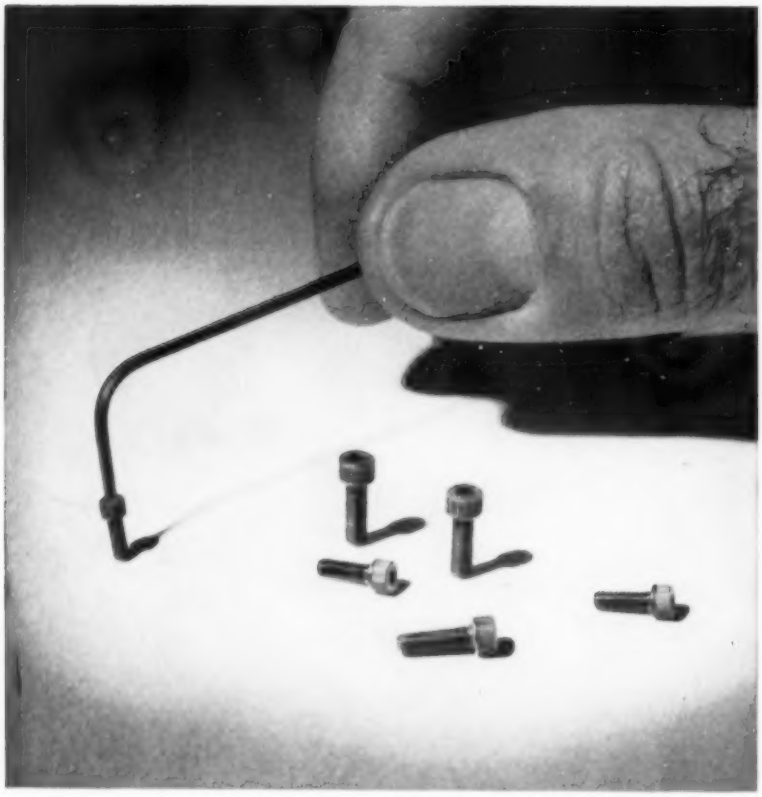
"Within a month, this plant swung over to TRUKUT in all grinders, as well as milling machines."

If *you* have a problem with grinding or cutting coolants, it will pay you to look into the advantages of Sinclair TRUKUT EP Soluble Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS and COOLANTS

Miniature screws aid standardization of small devices



Standard UNBRAKO miniature socket head cap screws are available in sizes # 0, # 1, # 2 and # 3, in heat treated alloy steel or stainless steel, at your authorized industrial distributor's. Standard lengths range from ⅛ to ½ in.

Tiny close-tolerance Unbrako screws available in standard sizes

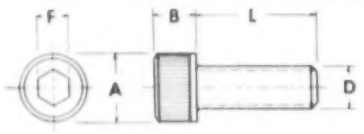
New economies in the design of space-saving miniature equipment are possible with these UNBRAKO miniature socket head cap screws. Manufactured to timepiece precision, available locally, they save the costly necessity of designing special screws to fasten tiny parts in compact units. They're ideal for use in typewriters, calculators and computers, servomechanisms, electric and electronic equipment—and in countless other small, intricate devices where maximum reduction in bulk and weight is required with no sacrifice in strength of individual components or assemblies.

Fingers grip the knurled heads on these tiny screws positively for easy handling and fast assembly. Uniform hex sockets assure maximum wrenching torque. Controlled fillets under the heads prevent shearing of the heads. Threads are fully formed for maximum strength and exact fit. Extremely accurate head diameters permit their use in countersunk holes, saving weight by reducing the length of the screw required and making flush designs possible.

These standard UNBRAKO miniature screws are available at your authorized industrial distributor's. See him today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

HEAT-TREATED ALLOY STEEL

Class 3 Fit Standard



	Diameter	Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0	A .104		80	⅛		2.0	.152
	B .060		80	3/16		2.0	.182
	D .060		80	¼		2.0	.210
	F .050		80	⅜		2.0	.265
#1	A .118		72	⅛		3.5	.27
	B .073		72	3/16		3.5	.32
	D .073		72	¼		3.5	.37
	F .050		72	⅜		3.5	.47
#2	A .140	56		3/16	6.0		.42
	B .086	56		¼	6.0		.50
	D .086	56		⅜	6.0		.58
	F 1/16	56		½	6.0		.70
#3	A .161	48		3/16	8.5		.59
	B .099	48		¼	8.5		.70
	D .099	48		⅜	8.5		.81
•	F 5/64	48		½	8.5		1.03

Standard Screws are threaded to the head. Special materials, lengths, and threaded lengths are available. One "High-Titan" UNBRAKO hex key is included with each package of 100 screws.

UNBRAKO®

SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

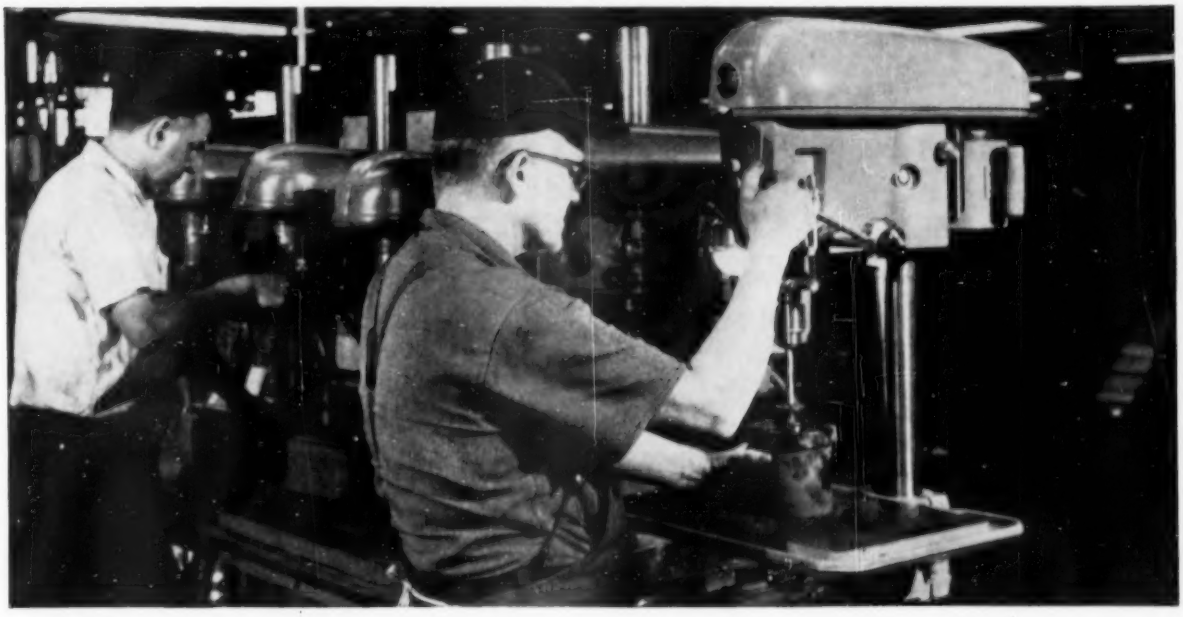
SPS

JENKINTOWN PENNSYLVANIA

WITH A KOLD OPTICAL HOLE BORER

ROCKWELL-BUILT

NEW DELTA 15" drill press



...replaces expensive special tooling

The new Delta 15" combines the ruggedness, power and precision of much heavier machines with unmatched power tool versatility. Here's how it can save you money on a wide range of jobs:

DOES MORE WORK MORE ACCURATELY—*Only* Delta offers a selection of *six* spindle adaptors for all production drilling operations—eliminates the need for costly single-purpose machines on many jobs. And each adaptor is mounted on a ground taper for *complete* accuracy, features a threaded collar for *positive* locking.

BIG MACHINE RUGGEDNESS—Delta's unmatched power tool know-how gives you extra rugged design and construction—massive one-piece head, big 2" dia. quill, oversized heavy duty ball bearings—that adds up to years of dependable, low cost operation even under heaviest everyday work loads.

EASY, CONVENIENT OPERATION—*Exclusive "universal" hand feed* combines the best features of pilot wheel and single lever feeds for adjustable leverage, freedom from striking table or fixtures, almost infinite choice of feed lever positions.

Counterbalanced belt guard completely encloses belt and pulleys, swings up for fast, safe speed changes. You get these and many more time and work-saving advantages found in no other 15" drill press!

SEE THE ENTIRE DELTA DRILL PRESS LINE—Get all the facts about the new Delta 15" and other new and improved Delta Drill Presses. Compare—then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

another product by **ROCKWELL**

Delta Power Tool Div., Rockwell Manufacturing Co.
620C N. Lexington Ave., Pittsburgh 8, Pa.

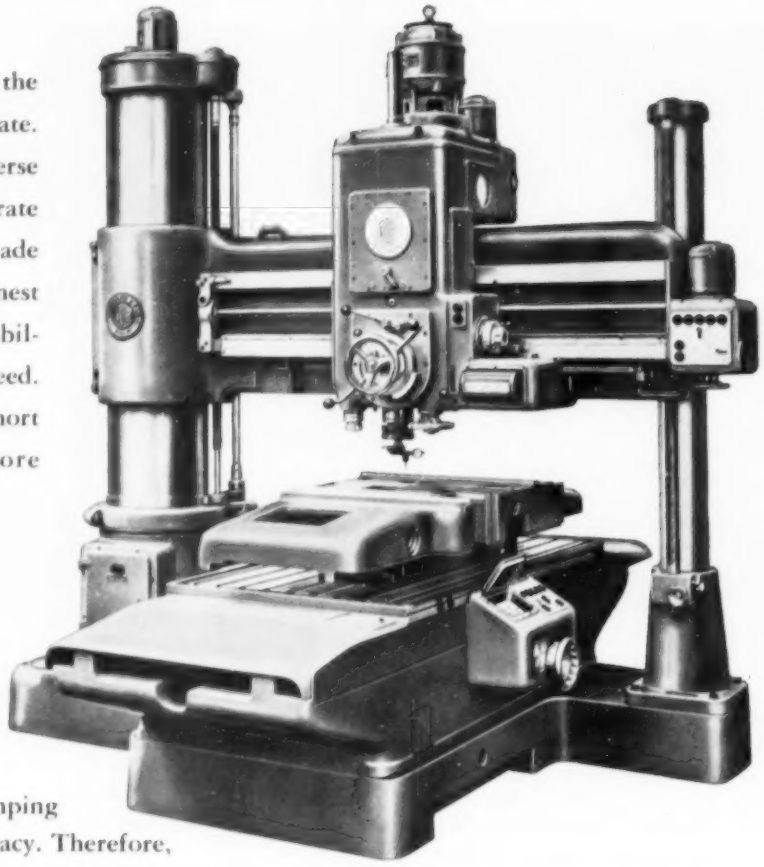
- ☐ Please send catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

Name _____ Title _____
Company _____
Address _____
City _____ County _____ State _____

WITH A KOLB OPTICAL JIG BORER

YOU CAN POSITION A WORKPIECE TO WITHIN .00005" IN A FEW SECONDS

Positioning a workpiece on the Kolb jig borer is fast and accurate. It's fast because of rapid traverse with adjustable stops—it's accurate because the optical system is made by Leitz, one of Germany's finest optical manufacturers. Repeatability of the coordinates is guaranteed. By eliminating costly jigs, short run jobs can be handled more profitably.



- Shock and distortion-free electro-hydraulic clamping does not impair accuracy. Therefore, reading accuracy equals positioning accuracy. Signal lights indicate if head and table are clamped or unclamped.
- Convenient pushbutton control—preselection of 18 feeds and 36 speeds.
- An excellent machine for drilling, boring, reaming, tapping and milling as well as precision measuring.
- Optical system has a magnification of 1:100—five inches on the focusing screen is equivalent to a movement of 0.05 inches along the coordinate.
- Working surface of table 69x39", clearance between columns 73", maximum distance between spindle and table 40".

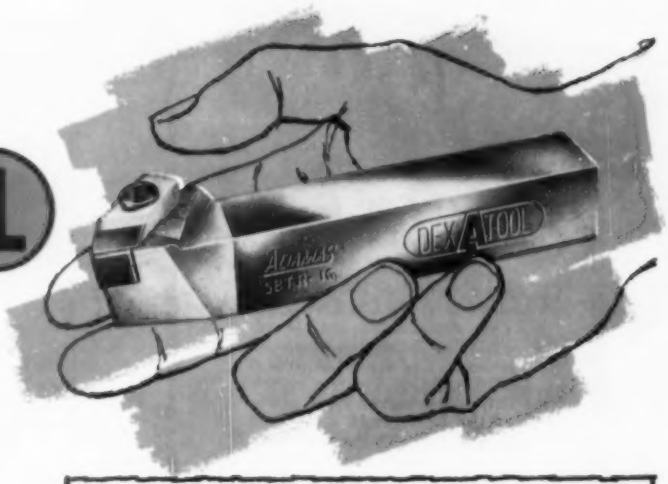
Write for more information.

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA—COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario

Only ADAMAS DEX-A-TOOL has ALL 4 FEATURES

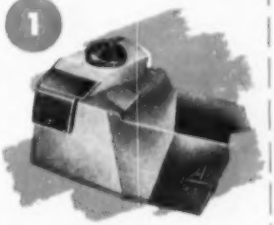


No other toolholder for "throw-away" inserts gives you as many extras-for-efficiency as DEX-A-TOOL by Adamas!

Talk about *fast* and *easy* to work with — DEX-A-TOOL's got them all beat for quick interchangeability, rapid indexing and fast, accurate chipbreaker location after indexing! And versatile? DEX-A-TOOL accommodates both "thin" (1/8") cutting tips with 1/32" nose radius *or* "thick" (3/16") carbide inserts with 3/64" nose radius!

DEX-A-TOOL's 7 styles and 56 sizes cover the full range of machining conditions! DEX-A-TOOL's precision engineering and many plus features add up to real trouble-free machining! Plan *today* to test DEX-A-TOOL on your own machines.

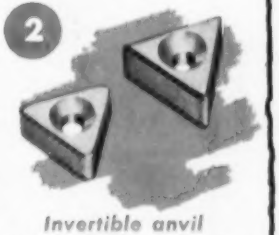
1



Adjustable chipbreaker

Combination chipbreaker clamp is easily adjustible for lightest to heaviest cuts . . . eliminates the need for a separate chipbreaker for varying feeds.

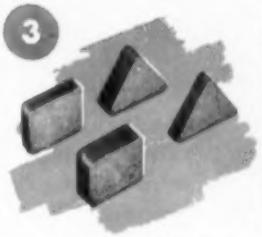
2



Invertible anvil

Invertible feature doubles life over other anvils . . . gives up to *8 times* the life over anvils which are not indexable and twice the life over anvils which are not invertible . . . copper plated, hardened tool steel or carbide.

3



Holds both "thick" and "thin" inserts

"Thick" and "thin" anvils accommodate 1/8" or 3/16" inserts of either carbide or Ceralox (Adamas ceramic cutting tool material).

4

Chipbreaker setscrew

Provides fast, precision relocation of chipbreaker.

There's so much to tell you about DEX-A-TOOL, we've put all the time and money saving facts in a special brochure. Send for your copy now! Address Dept. **233.**

ADAMAS

CARBIDE CORPORATION
KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL AND CERALOX.

ERRINGTON

UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD

Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.

LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

#0—0" to ¼" Tap Capacity
Min. centers 11/16"
Max. Pattern 5¼"

#1—7/32" to ½" Tap Capacity
Min. centers 1½"
Max. Pattern 8"

Send For Complete Information

ERRINGTON Mechanical Laboratory, Inc.
Established 1891
Main Office and Plant: STATEN ISLAND 4, NEW YORK

USE READER SERVICE CARD; INDICATE A-3-320-1

Makes drill press COMPLETE MACHINE TOOL

AMF Float-Lock Instant-Change Vise

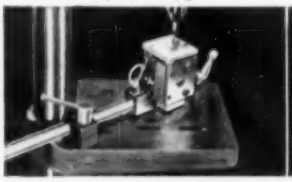
Positive anchoring . . . "Floats" and "Locks" in any position. Thumb-operated release ring permits instant change of jaw opening. Bosses on 2" centers provided on ratchet jaw for jig plates. Two models . . . 9" and 12" capacities. Special safety vise for band-saw also available.

Send for complete literature now.

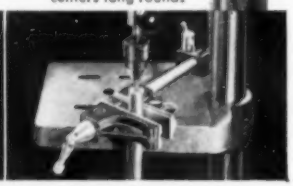
Another AMF Product
Float-Lock SAFETY VISES

AMF TOOL DIVISION
AMERICAN MACHINE & FOUNDRY COMPANY
224-A Glenwood Avenue, Bloomfield, New Jersey

quick drill jig



centers long rounds



USE READER SERVICE CARD; INDICATE A-3-320-2

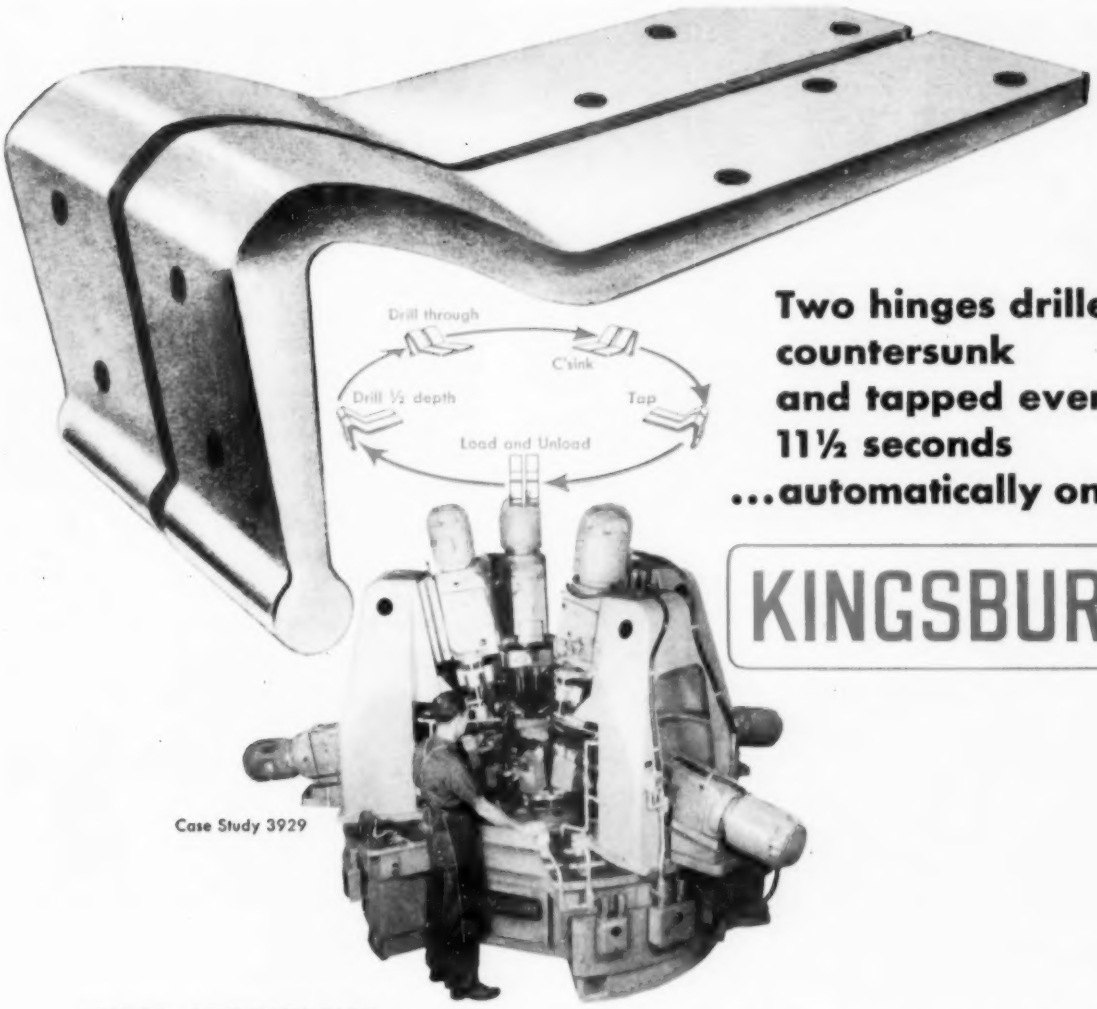
Accuracy in Hardness Tests insures Quality Control

Solve quality control problems with the King Portable Brinell Hardness Tester. Take faster, more accurate hardness readings on heavy, odd-shaped metal parts without elaborate fixturing or cutting samples. The King Portable uses a 3000 kg. load on a 10 mm. ball with automatic relief. Intermediate loads as desired. This precision instrument saves handling and set-up time, and is so versatile, it soon pays for itself many times over. Weighs less than 30 pounds and makes guaranteed accurate tests anywhere.

For complete specifications on standard testing machines or adaptations made to your special requirements, write

KING TESTER CORPORATION
Dept. T, 440 North 13th St., Philadelphia 23, Pa.

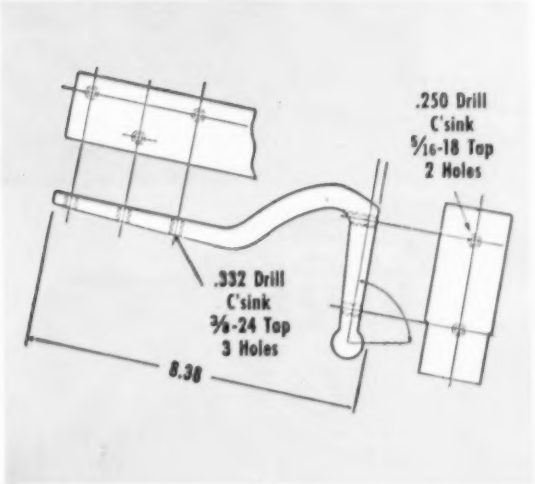
USE READER SERVICE CARD; INDICATE A-3-320-3



Case Study 3929

Two hinges drilled, countersunk and tapped every 11½ seconds ...automatically on a KINGSBURY

THREE OPERATIONS FROM TWO DIRECTIONS ON THIS FORGED STEEL HINGE ...620 PARTS PER HOUR GROSS



The print shows the angle at which the fixtures hold the work. This angle allows room for four vertical units (three visible in the photo). Each fixture holds two parts. The four vertical units drill half depth, drill through, countersink and tap three holes in each part. Two-step drilling shortens the time cycle and increases the production rate. Four angular units (only three visible in photo) perform similar operations on the two holes. The operator unloads a finished part, loads a rough one and pushes a button to index the table. After the table indexes, all units operate automatically.

All Kingsbury machines are completely tooled and ready to produce. We run test samples and ship them to you for your approval before we ship the machine. For high production drilling and tapping, a Kingsbury is the best machine you can buy. May we talk to you about your jobs?
Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping

Talide Die

cuts molding cost

7¼¢ to 1¢...

● Simonds Abrasive Company, a leading producer of abrasive wheels, called in a Talide Die Engineer to help reduce excessive die costs. The highly abrasive action experienced in molding the wheels to shape cut service life of hardened steel dies to 3000 wheels. A Talide carbide die having 6" I.D. was designed and, due to its super hard and dense structure, approximately 25 times the number of wheels were pressed! $4,708.80 worth of steel dies would have been required to equal the production of this one $690.00 Talide die. **Metal Carbides Corporation, 6001 Southern Boulevard, Youngstown 12, Ohio.**

SIMONDS ABRASIVE COMPANY

February 13, 1956

Metal Carbides Corporation
107 E. Indianola Ave.
Youngstown 7, Ohio

ATT: Mr. R.T. Beeghly

Dear Mr. Beeghly:

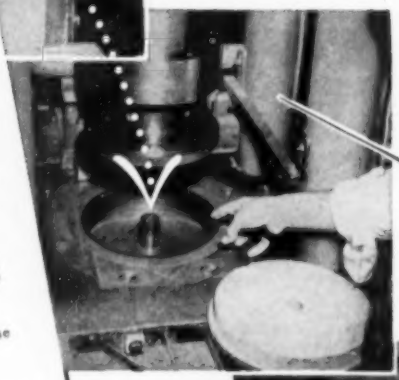
At the request of your Mr. J.R. Macek, I am forwarding information about our molding die costs for the manufacture of grinding wheels pressed on an automatic press.

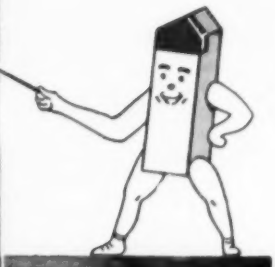
When we first began to use automatic presses in our process we set up with steel dies which gave us a molding die cost of $.0725 per piece produced. We then went to Metal Carbides dies which gave a per piece die cost of $.0175. Further changes to a different grade have given a per piece die cost of $.015.

We have recently had one of these dies reworked and have noted still further increase in life and a per piece die cost of $.0106.

Needless to say, we are quite pleased with the results obtained. If we can produce further information, please let us know.

Very truly yours,
SIMONDS ABRASIVE COMPANY
William Kohn
Tool Engineer





DEEP DRAW DIES

25,680,000 outlet boxes drawn with TALIDE—Steel dies average 700,000.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE Pill dies last 4 months, steel dies wore out in 6 hours.

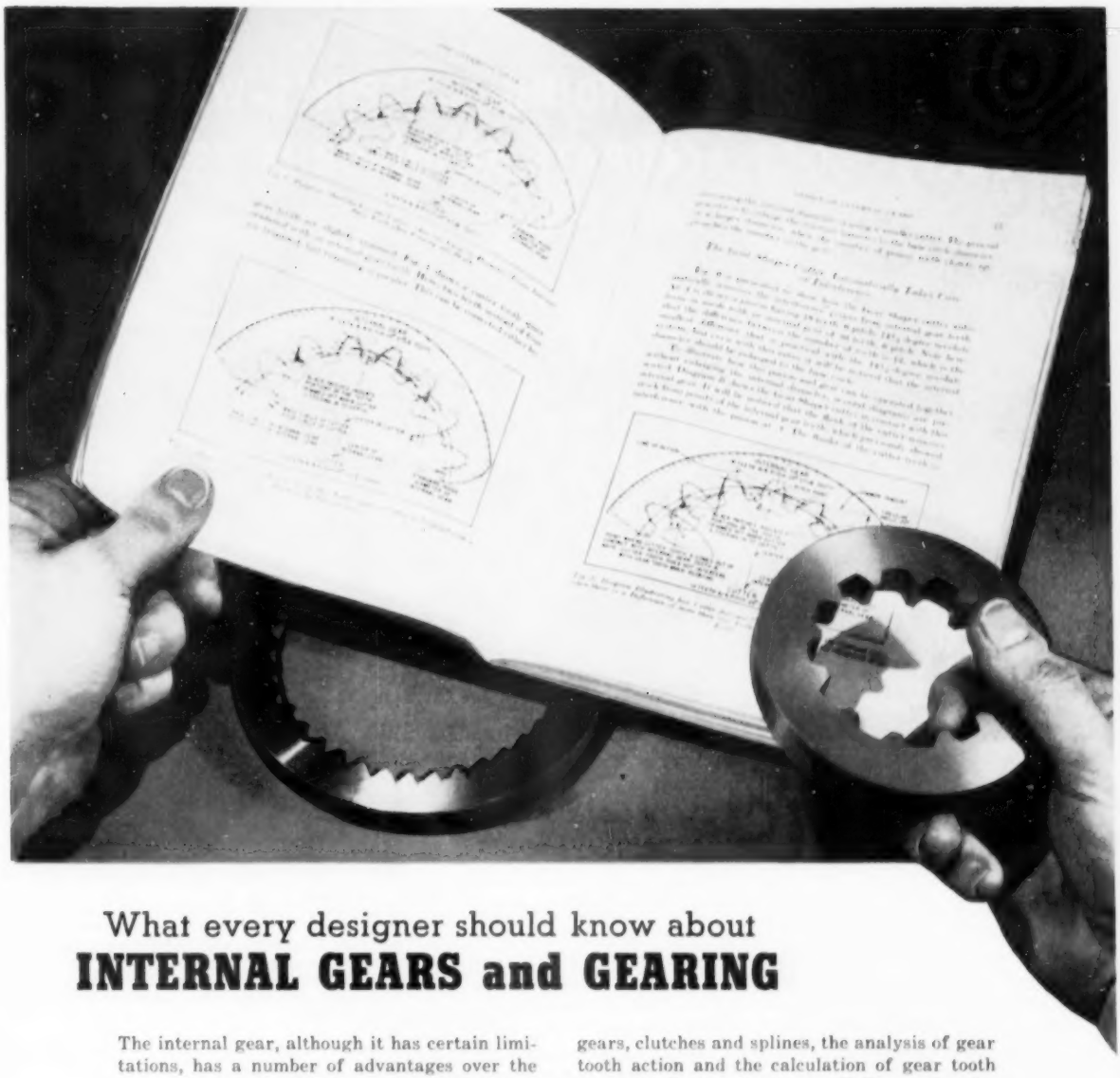
HEADING AND EXTRUSION DIES

Cold-heading ¼" C-1008 steel rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

Send for Catalog 56-G or ask for Talide Die Engineer to call

METAL CARBIDES CORPORATION
MC TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY



What every designer should know about
INTERNAL GEARS and GEARING

The internal gear, although it has certain limitations, has a number of advantages over the external gear, especially from the standpoint of compactness of design and more efficient tooth action. Most of the so-called limitations can be readily overcome by a proper understanding of the conditions to be met.

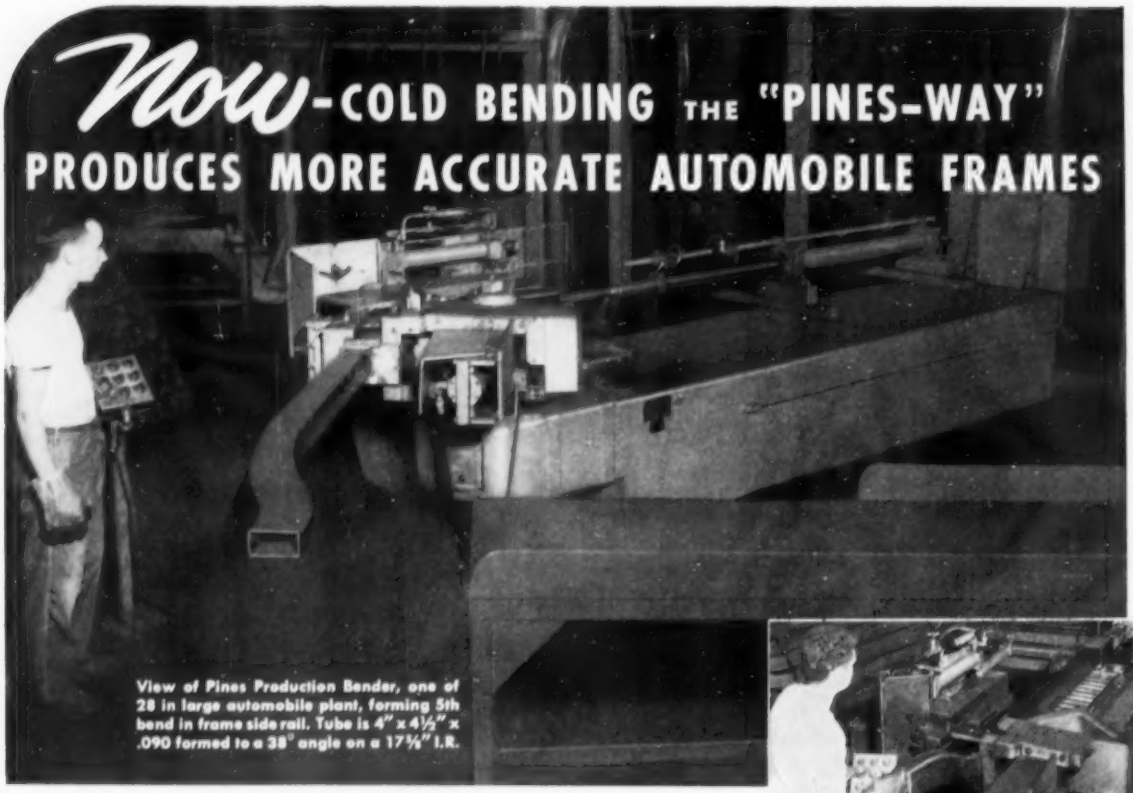
These advantages and limitations are explained in "The Internal Gear", a complete treatise on Internal Gear Design. This booklet contains information on the design and cutting of internal gears, clutches and splines, the analysis of gear tooth action and the calculation of gear tooth strength. Just write to any Fellows office for your copy.

Internal gears, as well as an almost unlimited variety of other internal contours, can be produced at low cost on Fellows Gear Shapers. In many cases the same Gear Shaper cutter can be used to cut both the internal gear and its mating pinion. Production is as simple as the production of external gears.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE Fellows *Gear Production Equipment*

Now-COLD BENDING THE "PINES-WAY" PRODUCES MORE ACCURATE AUTOMOBILE FRAMES



View of Pines Production Bender, one of 28 in large automobile plant, forming 5th bend in frame side rail. Tube is 4" x 4½" x .090 formed to a 38° angle on a 17⅛" I.R.

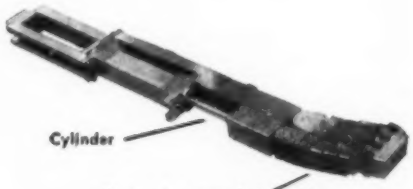
▲ Close-up view of machine used to produce 4th bend in long side rail member. Five different bends are made in this piece, each in sequence on separate machines. Accuracy is held within .030" to .045" at seven check points. Spring-back is easily controlled by simple stop settings — an important factor that cuts tool costs.

Production Bending Methods Simplify Fabricating Problems, Cut Assembly Costs

● The unusual versatility of Pines Bending Machine methods is again demonstrated by the successful production line application shown above in a large automobile manufacturer's frame plant. Proven by more than 18 months of operation, a battery of 28 special Pines Benders are now forming .090 tapered welded steel tube frame members at a rate of 120 bends per hour. These machines and ingenious tooling, designed and built by Pines, form a total of seven bends in each side rail member and produce more accurate parts than ever before possible. The end result is a stronger, more accurate chassis that is much easier to assemble to the car body.

Typifies Progress in Cold Bending Techniques

This revolutionary new manufacturing method is the result of long months of cooperative efforts between Pines and automotive engineers. It is typical of the consistant progress being made in profitable application of cold bending in the manufacture of a wide variety of metal products. It may also pay you to investigate the design possibilities and the production advantages of cold bending the "Pines-way." At your first opportunity call in our Sales Engineers for free survey.



▲ View of a flexible articulate mandrel used for making a bend at a right angle to, and within, a previously bent section. Mandrel is automatically inserted and expanded. Insures smooth, neat bends.

Write FOR MORE DATA

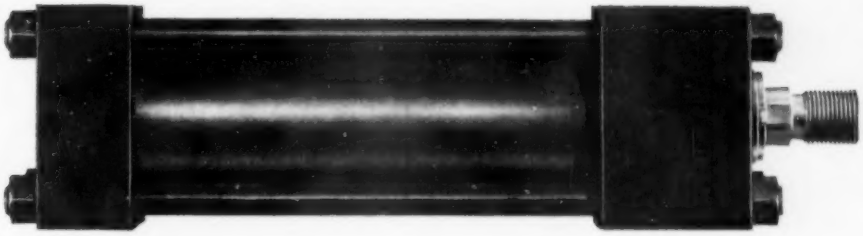
If you would like case study data on production bending, write today for free copies of Pines News.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

693 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY



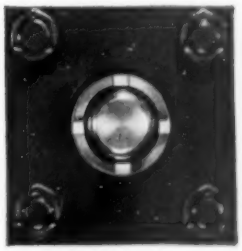
designed for leadership!

The superiority of Hannifin cylinders begins on the drawing board, where Hannifin designers have originated feature after feature not found in other air and hydraulic cylinders. But it doesn't end there...

Hannifin offers more kinds of cylinders, more sizes, more mounting styles. Each manufactured with such exacting control of dimensions and finishes that it not only looks like a better cylinder—its performance proves it!

As more and more discriminating specifiers and buyers are finding, the extra quality you get from Hannifin costs you no more, can usually be delivered sooner.

Why not specify Hannifin by name when you buy?



AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.

Produced in a modern plant under ideal controlled conditions, with quick deliveries from stock as a special service to HEMCO customers.

HEMCO-PROCESS GAGES

Try Them — Let Them Write Their Own Performance Ticket For You

MUCH LONGER WEAR LIFE — so much more life you'll wonder how it can be possible. Put HEMCO-PROCESS GAGES to the test in your own applications, and this extra wear life will reveal itself in a most convincing demonstration.

MUCH LOWER COST — so much less money to invest in your working gage needs, you'll count your savings in terms of thousands of dollars, — thanks to HEMCO-PROCESS GAGES low initial cost and their wear life.

MUCH HIGHER GAGE QUALITY—a precision quality you can see and feel, —quality that stamps HEMCO-PROCESS GAGES the ultimate in their field.

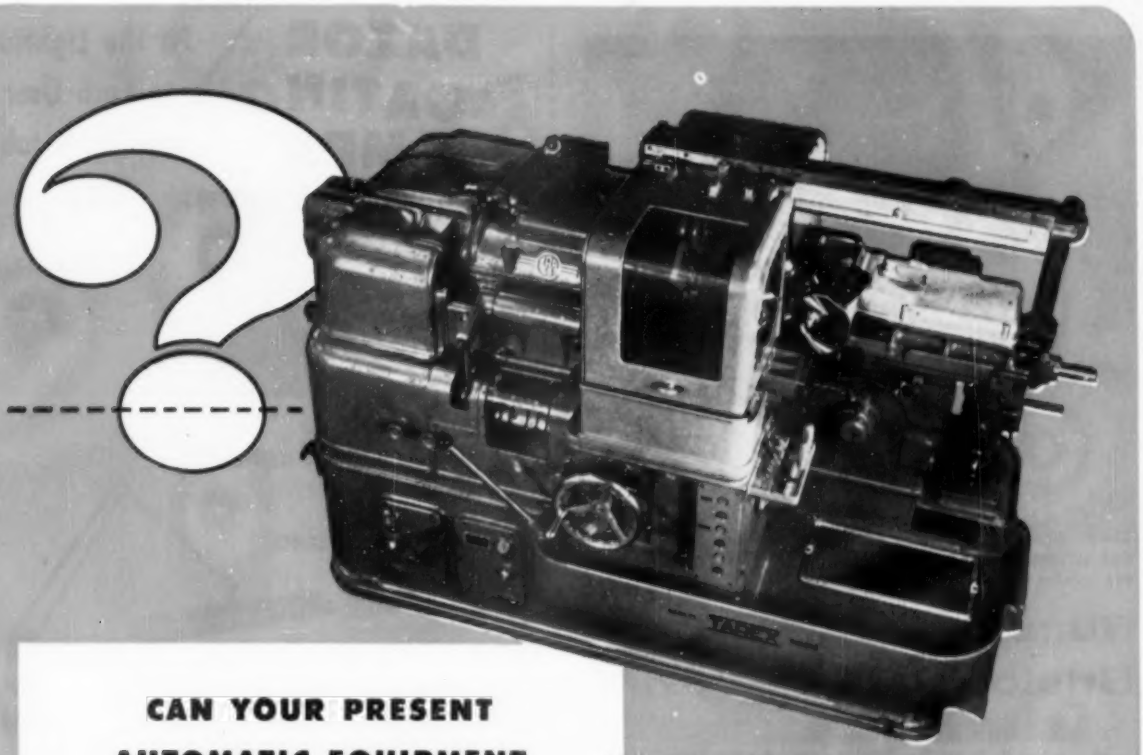
THE ANSWER TO ALL THIS is found in the exclusive HEMCO PROCESS, — the only process that imparts a super hard Chrome surface unqualifiedly guaranteed not to chip or peel, no matter what type of gage. Case histories, covering all kinds of industrial and U. S. Procurement customer situations, prove the superior merit of HEMCO-PROCESS GAGES.

All types and sizes of standard working gages, as well as special types for even the most unusual applications, engineered to customer specification.

Inquire about the COMPAROSCOPE — the versatile optical instrument for evaluating surface finishes.

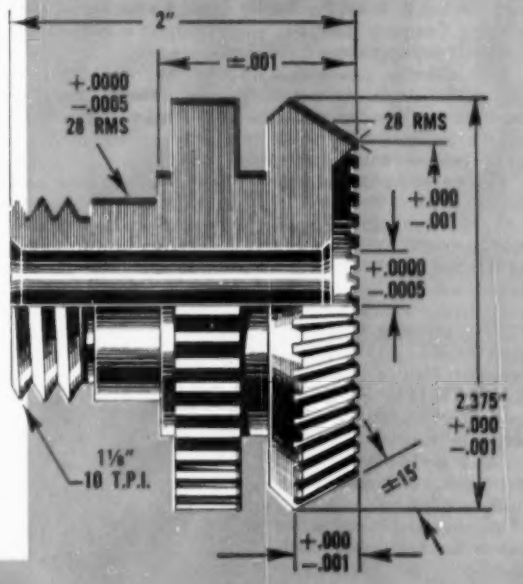
DISTRIBUTORS are invited to request information on available opportunities.

H. E. MORSE CO. • HOLLAND, MICH. • (TWX – Holland, Mich., #567)



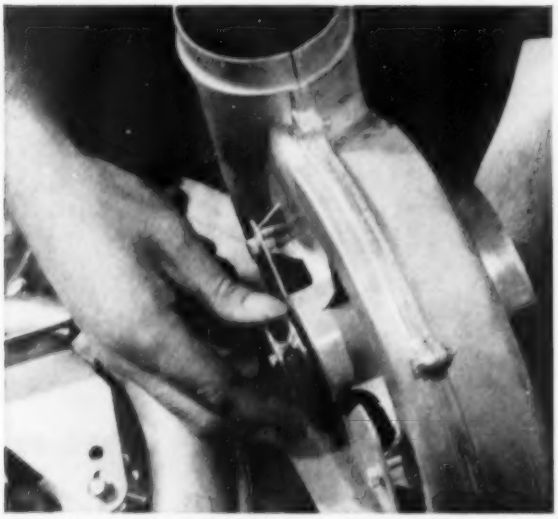
CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* **BEVEL CLUSTER GEAR** *complete* **FROM BAR STOCK** *in one operation* **READY FOR GEAR CUTTING?** *...it can be done on the*

TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



ONE BRISTOL MULTIPLE-SPLINE SOCKET SCREW holds sheave to hot air unit impeller shaft in Lovell laundry dryer.

Runs lab tests...buys Bristol socket screws

That, in brief, is the report we get on Bristol socket screws from Stephen E. Riley, Purchasing Agent, for the Lovell Manufacturing Company, Erie, Pa., world's largest manufacturer of clothes drying appliances for domestic use.

"Our laboratory . . . made a series of comparison tests," Mr. Riley said, "employing various types of screws to fasten the drum shaft to the sheave. It was discovered that only Bristol Multiple-Spline socket screws, properly applied, would not loosen, but would bind indefinitely.

"Our engineers determined to use the Bristol screw exclusively . . ."

And that's not all. "The usage of two Bristol Multiple-Spline socket screws . . . not only increased our drum shaft protection, but resulted in a 10% saving . . ." The reason, Mr. Riley explained, was that the necessity for flatting the shaft of the 35-pound drying drum was eliminated, thus saving machining costs.

This is typical of the experience of Bristol socket screw users --with Bristol-originated Multiple-Spline or industry standard hex socket. They like the Multiple-Spline's ability to take extra wrenching torque enabling them to resist shock and vibration. And they like the precision workmanship of both hex and Multiple-Spline.

Find out about Bristol socket screws today. Sold through leading industrial distributors. A-6.29

FASTENING SHEAVE TO SHAFT of 35-pound drying drum with Bristol Multiple-Spline screw.

Precision socket screw manufacturers since 1913

Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½".

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-3-328-1

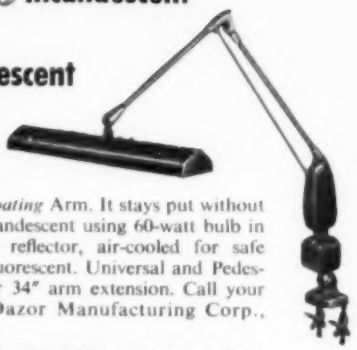
DAZOR FLOATING LAMPS

Fit the Lighting to Each User and Each Job

Top-Mounted Reflector

Side-Mounted

Air-Cooled **Incandescent or Fluorescent**



People . . . jobs . . . lighting needs differ. Let each employee control light location with the Dazor *Floating* Arm. It stays put without locking. Choice of Incandescent using 60-watt bulb in top- or side-mounted reflector, air-cooled for safe handling; or 2-tube Fluorescent. Universal and Pedestal models with 24" or 34" arm extension. Call your Dazor distributor. Dazor Manufacturing Corp., St. Louis 10, Mo.

USE READER SERVICE CARD; INDICATE A-3-328-2

CONCENTRIC LIVE CENTERS

the original, patented

spring loaded live centers

AUTOMATIC THRUST ADJUSTMENT
Spring loaded spindle maintains constant tail stock thrust.

LONGER LIFE
Needle bearing distributes bearing stress over greater surface, thus holding close tolerances for much longer time.

FASTER SPEEDS
Smaller turning radius gives much higher RPM rate than ordinary **live** centers.

GREATER LOAD CAPACITY

LESS OVERHANG MEANS MORE RIGIDITY . . MORE WORKING RANGE

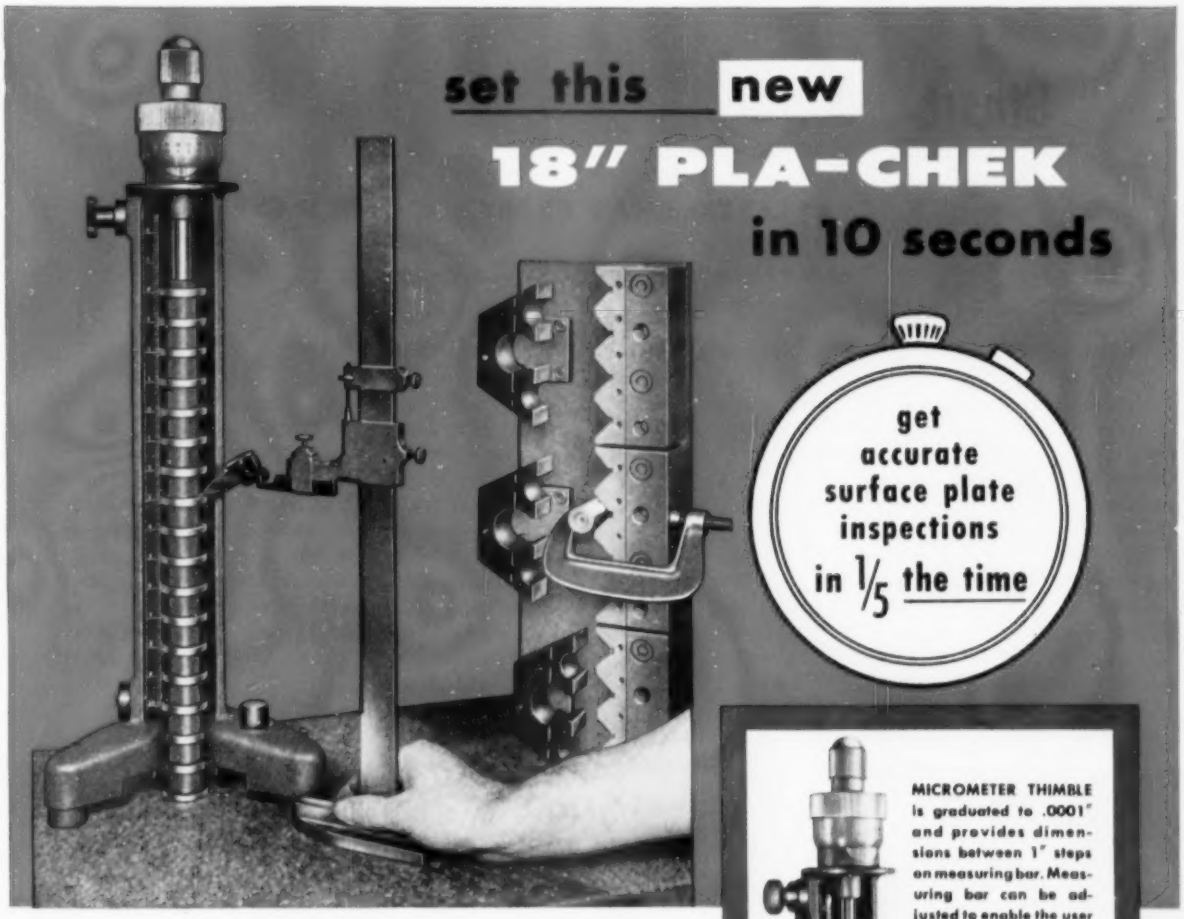
JAM PROOF

Write today for complete information

Pat No. 2,820,473

CONCENTRIC TOOL CORP., 2486 Huntington Dr., San Marino, Calif.

USE READER SERVICE CARD; INDICATE A-3-328-3



MICROMETER THIMBLE is graduated to .0001" and provides dimensions between 1" steps on measuring bar. Measuring bar can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

accurate to .00005" throughout the 18" range

That's right! Just 10 seconds to set this NEW 18" PLA-CHEK GAGE . . . and you are ready to start your inspections. In hundreds of installations on innumerable jobs PLA-CHEK GAGES are daily proving their time-saving and money-saving advantages. Extremely easy to operate—no auxiliary gage blocks are necessary—this PLA-CHEK 18" model guarantees accuracy to fifty millionths through its entire range. The measuring bar is made of deep-frozen, strain-free alloy steel. Because it is of one-piece construction the steps cannot change or separate with age. Since it is not necessary to touch the measuring bar, body heat does not affect it. Return the coupon or write TODAY for literature and complete details.

Cadillac PLA-CHEK GAGES are available in a complete range of sizes: 6", 12", 18", 24", 36", and 48" models. Precision-made risers, increasing the range of each model, are also available.

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name _____

Company _____

Address _____

City _____ Zone ____ State _____

Cadillac
GAGE COMPANY
P. O. BOX 3806 • DETROIT 5, MICHIGAN

Stuart SOLVOL

LIQUID CUTTING COMPOUND

Lubricates as it Cools

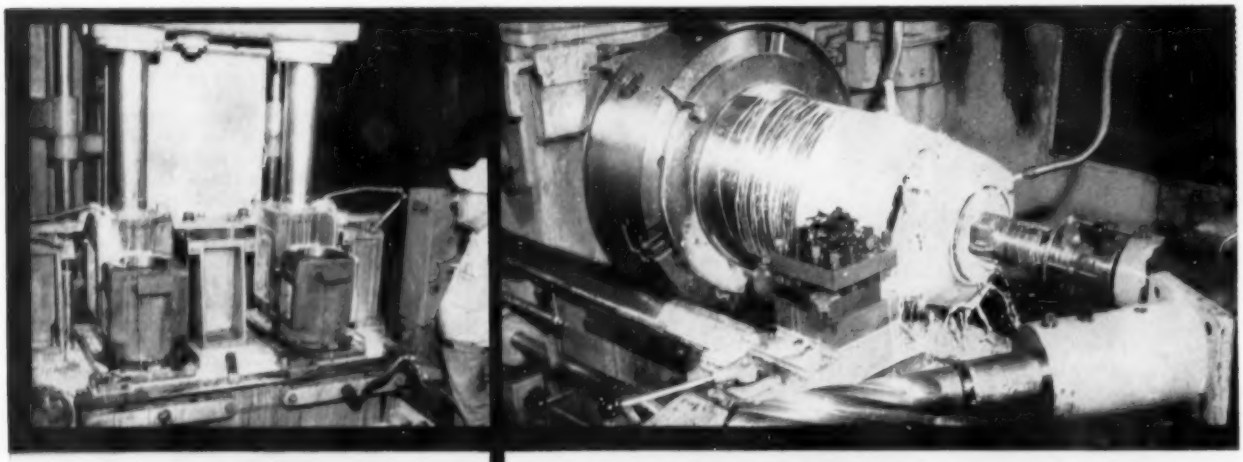
Keeps Gardner-Denver Company's difficult production jobs "right at peak"

"Solvol prolongs cutting-tool life . . . increases production . . . reduces costs . . . and keeps production right at peak," —that's the report from Gardner-Denver Company, Quincy, Illinois, where Stuart's Solvol is used as a multi-purpose cutting oil to produce profit-boosting benefits ordinary "coolants" can't give.

Solvol's excellent combination of lubricating and cooling qualities has stepped up performance on 30 different machines used for milling, drilling, turning, and boring in this manufacturer's main plant at Quincy, Illinois. The four jobs illustrated are typical of the way Gardner-Denver engineers maintain machine and cutting-tool efficiency, producing parts for compressors, pumps, rock drills, and other heavy equipment.

They are typical, also, of the way Stuart's Solvol is used in profitable plants everywhere for high-speed turning, vertical surface broaching, round hole broaching, and similar heavy-duty jobs on which water-mix cutting oils are indicated.

For Solvol *lubricates as it cools*, keeps tool wear down by providing a tough protective film of oil at the cutting edge . . . allowing chips to slide freely up the face of the tool . . . minimizing heat caused by friction on heavy cuts taken at high speeds.

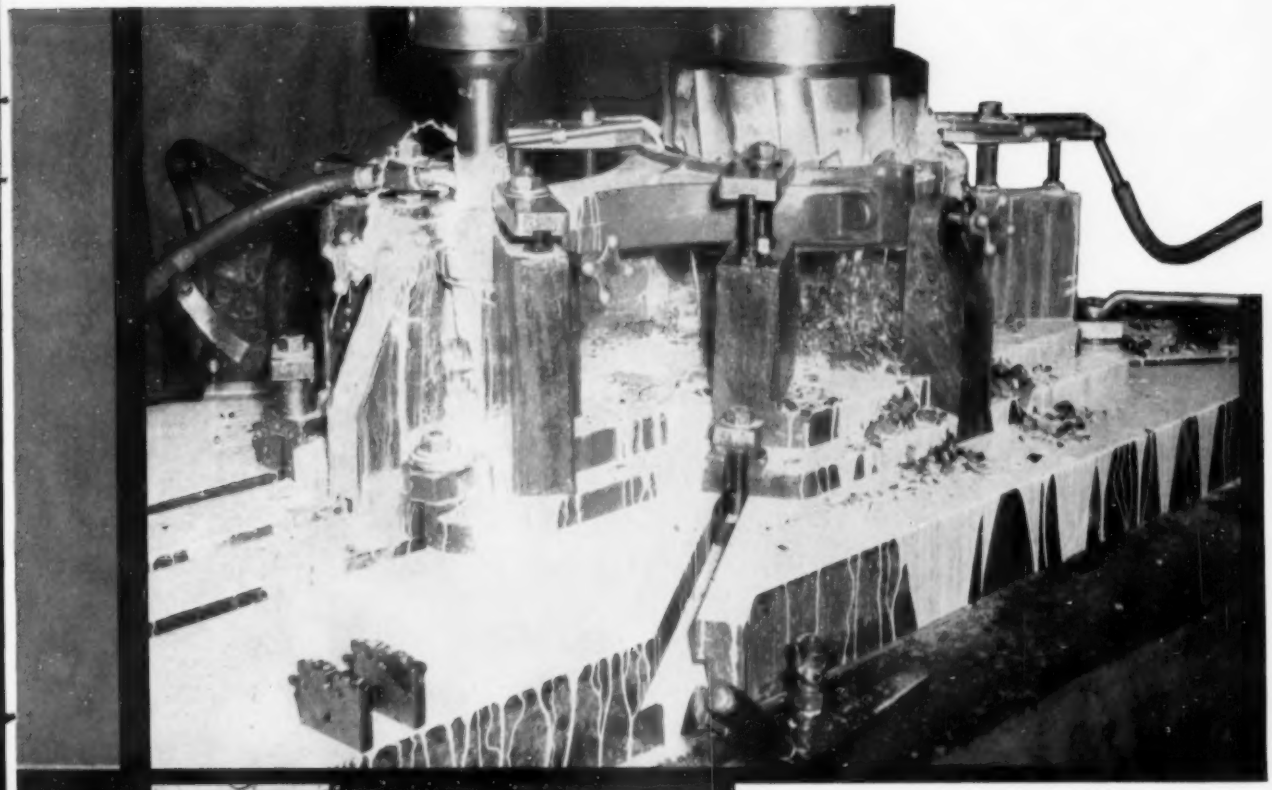


Boring operation on cast-iron compressor cylinders removes .019 in. stock. Feed is 3.5 in. per minute . . . production time, 7.69 minutes per piece. Solvol eliminates "edge build-up."

Prolongs tool life on this high-speed turning operation. Up to ¼ in. of stock is removed from these cast steel cylinder cross-heads at speeds of 300 sfpm. Standard 30-to-1 Solvol and water *absorbs heat rapidly and reduces friction for good utilization of power without excessive tool wear.*

SOLVOL helps you cross the heat barrier in metal-cutting

Stuart's Solvol liquid cutting compound controls the heat problem more effectively on practically all high-speed metal-cutting operations. Each ingredient of Solvol was chosen for specific qualities which prolong cutting-tool life . . . protect machines . . . maintain high standards of accuracy and finish . . . and assure greatest on-the-job economy. Solvol has high detergency plus superior emulsifying and rust-inhibiting qualities. Heavy-duty pure fatty oil increases surface wetting characteristics and boosts the lubricating factor of the petroleum base. Experience-proved emulsifiers increase stability and prolong Solvol's effectiveness. Standard starting mixture is one part Solvol to 30 parts water . . . other mixtures are used to meet unusual requirements. Your Stuart sales engineer will be glad to give you specific recommendations that reduce your operating costs and step up performance.



Tough milling job upgraded by Solvol's lubricating, cooling, and anti-rust qualities, machining two bores in heavy cast steel connecting rods (above). No chip "weld" on cutting edges... *lubricating and rust-inhibiting* qualities protect machine and fixtures. Pregrind operation removes up to .010 in. stock from each bore. One rod finished to within ± .002 in. every 33 minutes.

Carbide-tipped face mill takes heavy cut on this large slush pump connecting rod. Solvol withstands high unit pressures... provides *a tough film of lubrication* to reduce friction and prevent excessive heat build-up.

Phone your
Stuart Service Center

Arrange now to test Stuart's Solvol on your difficult metal-cutting jobs.

DETROIT, MICH.	Tyler 7-8500
CHICAGO, ILL.	Bishop 7-7100
HARTFORD, CONN.	Jackson 7-1144
CLEVELAND, OHIO	Prospect 1-7411
PHILADELPHIA, PA.	Devonshire 8-6100
TORONTO, CANADA	Oxford 9-9397

Representatives in all principal cities

SINCE 1865

D. A. STUART OIL CO.
2727 South Troy Street, Chicago 23, Illinois

CANADIAN D. A. STUART OIL CO., LIMITED
3575 Danforth Avenue, Toronto 13, Ontario

Stuart

METALWORKING LUBRICANTS

high scorer

. . . and in high speed steels, it's always REX

Crucible's REX® high speed steel always scores highest on performance—as it has for more than a half century. That's because it is consistently sound and uniform in structure . . . with dependable response to heat treatment.

But don't take our word for it. Check REX for yourself—by any test you choose. You'll discover that recent improvements in manufacturing techniques have made it better than ever—why REX is today, as it's always been, *the standard by which all other high speed steels are compared!*

REX is immediately available at all Crucible warehouses, or on prompt mill delivery. For a list of helpful data on REX and other *special steels*, write for a free copy of the "Crucible Publication Catalog." *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

Without SCREW THREADS not one of these products for modern living would be possible. And, only *taps* generate internal screw threads with the speed and precision demanded by modern production methods.

But, today your precision tapping jobs cannot be entrusted to *just any tap.* Your taps must be backed by precision engineering, precision measuring tools and time earned know-how. There is a big difference in using *just any taps* and using TAPS by GREENFIELD.

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

Photo courtesy of the R. K. LeBlond Machine Tool Company

THE LATHE — *LeBlond 25" Heavy Duty Engine Lathe*

THE OPERATION — *Rough sizing a steel 25" heavy duty spindle forging, using a 1/2" cut*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON Since 1851 CHUCK

Call Your Horton Distributor Now!

BUILD YOUR OWN

BLISS
SINCE 1857

DIECO

E. W. BLISS COMPANY

DIE SUPPLY DIVISION

1400 Brookpark Road, Cleveland, Ohio

PLANTS AND OFFICES

BURBANK, CALIF.
CLEVELAND, OHIO
DAYTON, OHIO
DETROIT, MICH.
PITTSBURGH, PA.
SAN JOSE, CALIF.

DISTRIBUTORS

BIRMINGHAM, ALA.
Ford Tool and Carbide Co.
BUFFALO (Depew), N. Y.
Buffalo Die Supply Corp.
CEDAR RAPIDS, IOWA
Midland Supply, Inc.
CHARLOTTE, N. C.
Apex Machine Tool Supply, Inc.
CHICAGO, ILLINOIS
Joseph M. Matis
DALLAS, TEXAS
Tool Products Co.
DAVENPORT, IOWA
Midland Supply, Inc.
DENVER, COLO.
Overgard Machine Tool Co.
GRAND RAPIDS, MICH.
B. H. W. Tool Sales, Inc.
HAMILTON, ONTARIO, CANADA
Higginson Engineering Sales
KANSAS CITY, MO.
Ellfeldt Machinery & Supply Co.
MILWAUKEE, WIS.
Tool and Die Supply Co.
MINNEAPOLIS, MINN.
Northern Machinery & Supply Co.
MONTREAL, QUE., CANADA
L. S. Tarshis & Sons, Ltd.
PORTLAND, OREGON
Western Steel Sales, Inc.
SEATTLE, WASH.
The National Co., Inc.
ST. LOUIS, MO.
Scott Special Tools, Inc.
TULSA, OKLA.
Krisman Industrial Supply Co.
WICHITA, KAN.
Ellfeldt Machinery & Supply Co.

BUILD YOUR OWN
AUTOMATIC DRILLING OR TAPPING MACHINE

With Govro-Nelson Automatic Drilling and Tapping Units, together with the bases and electrical controls which we can supply, you can build yourself an automatic drilling or tapping machine at substantially lower cost than a special machine.

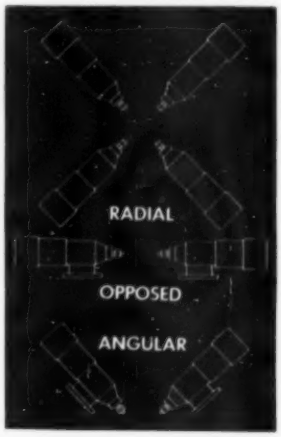
Any number of units may be employed. Examples of the various ways in which they may be arranged are shown at the right.

DRILLING UNITS

The Drilling Units are made in several sizes with spindle speeds from 1100 to 3450 RPM. Drill Units have full Hydraulic Control with external adjustment for the rapid approach, the rate of feed and the length of stroke. Suitable for drills up to ⅜", depending on material.

TAPPING UNITS

The Tapping Units are available in two sizes with 550 and 1725 RPM spindle speed. Features include no clutch and no lead screw and automatic adjustment for various leads. Suitable for tapping 0-80 to ⅜-16, depending on material.



Write for Literature

Automatic **DRILLING UNIT**

GOVRO-NELSON CO.
Machinists of Precision Parts for 34 Years
1933 ANTOINETTE DETROIT 8, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-336-1

Drill Hardened Steels without Annealing—

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.
1414 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

USE READER SERVICE CARD; INDICATE A-3-336-2

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-3-336-3

OPERATE HORIZONTAL MILLING MACHINES?

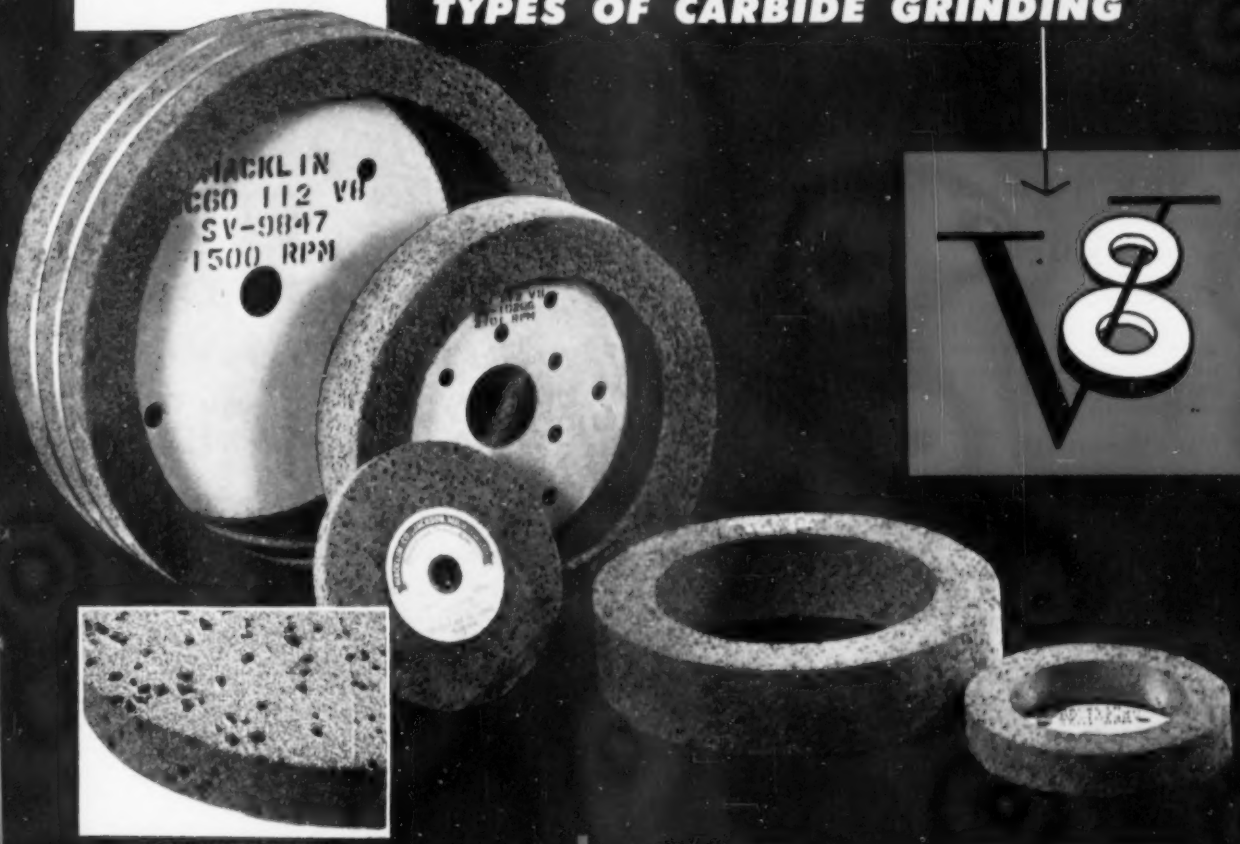
FREE DETAILS illustrate how you can increase horizontal milling machine feeds and speeds up to 200%. Jergens tapered roller bearing bushing replaces present bronze bushing at low cost without machine change. Eliminates bushing wear, cutter breakage, arbor wear, scoring and chatter. Permits use of carbide cutters to full capacity on new or old machines. Write for cost cutting facts today!

DONLEY PRODUCTS, INC.
Dept. TP-3, 11106 AVON AVE., CLEVELAND, OHIO

USE READER SERVICE CARD; INDICATE A-3-336-4

NEW MACKLIN

INCREASES PRODUCTION ON ALL TYPES OF CARBIDE GRINDING



CONTROLLED POROSITY
Note the open pore structure on this close up of a Macklin V-8 Wheel.

The new Macklin V-8 Wheel sets new standards of grinding performance. OPERATORS LIKE IT because of its soft, smooth "feel". It's easy on the wrists, easy on the tools, *cuts faster with less push.*

MANAGEMENT LIKES the long wheel life of the V-8 wheel, the way it increases production and cuts operator fatigue.

- V8 ***CUTS FASTER WITH LESS PUSH***
- V8 ***EASIER ON TOOLS***
- V8 ***EASIER ON OPERATOR***
- V8 ***HAS A SOFT, SMOOTH "FEEL"***

TEST V8 ON YOUR OWN JOB

It's a fact. Test the new V-8 Wheel on any one of your carbide grinding jobs and you'll switch! You get faster, cooler cutting . . . longer wheel life. But don't take our word for it. Test the V-8 Wheel *in your own plant . . . on your own job*

FOR A DEMONSTRATION WITHOUT OBLIGATION, CONTACT YOUR NEAREST MACKLIN DISTRIBUTOR OR CALL FOR THE SERVICES OF A MACKLIN FIELD ENGINEER.

V8 THE NEWEST IN MACKLIN'S "WHEELS OF PROFIT" FOR INDUSTRY

MACKLIN company DEPT. 81 JACKSON, MICHIGAN

THEY'RE BOTH TWO DIAMETER DRILLS . . .

BUT WHICH ONE SHOULD YOU USE?

STEP TOOLS VS. SUBLANDS

Manufacturing Accuracy:
Subland tools are turned, machined, ground and faced—all operations between centers for ultimate accuracy. Step tools are chucked in single collet and ground to approximate desired size.

Maintenance:
Sublands tools incorporate separate lands for each diameter—thus they can be accurately resharpened many times. Step tools must be *remade* during sharpening procedure—losing concentricity and continually weakening tool.

Performance:
Subland tools are built right to work right. They perform their precision operations flawlessly because they are accurately designed. They cost slightly more than standard tools—but they outlast them many times.

Results:
Tool test reports prove conclusively that Sublands out-perform standard or step type tools on practically all continuous, multiple drilling operations.

Versatility:
Subland tools can be made to accurately and dependably perform any practical number of operations—simultaneously! Accordingly, they pay for themselves in time, tools and equipment.

A MOHAWK SUBLAND . . . *NATURALLY!*

Mohawk Subland Drills are the modern answer toward faster, more accurate, economical combination tooling operations plus amazing production saving.

Why stock heavy inventory of widely varied step type tools for consecutive drilling operations? One pass with a Mohawk Subland Drill will do the work of two, three, four—or more—*ordinary* drills because Sublands last longer . . . stay accurate through multiple regrinds . . . and reduce hole costs.

A Mohawk Subland is the one versatile tool that will quickly pay for itself in man hours, equipment and tool dollars. They're immediately available in an amazing range of "Off-the-Shelf" Size-Optional sizes and types for every conceivable drilling combination. Highly specialized types are also readily available.

Write . . . Wire . . . Phone . . .

today for your Mohawk Subland Tool Catalog and/or the new brochure on Sublands vs. Step Tool operations. They're yours for the asking . . . and if you are interested in combination drilling operations, you'll find dozens of ways to save your equipment dollars.

NORMAL DELIVERY ON MOHAWK SIZE-OPTIONAL SUBLANDS—ONE WEEK FROM RECEIPT OF ORDER!

world's largest producers of Sublands

Mohawk TOOLS, Inc.
Montpelier, Ohio

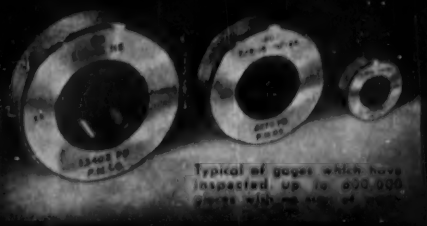
Now!

- TROUBLE-FREE
- ACCURACY
- LONG-LIFE
- FASTER GAGING

with

PMCo Ring Gages

With this proven fixed-type Titanium PMCo Carbide Thread Ring Gage you get all the headlined advantages



Typical of gages which have inspected up to 400,000 pieces with no wear of

plus such important benefits as these: use of full product tolerances, no maintenance, assured thread fit after inspection, and ease in handling due to unusually light weight.

Here's why: Pipe Machinery Company's ingenuity and craftsmanship has made it possible to use the round solid design, machine titanium carbide and hold to very close tolerances, achieving standards believed impossible only a decade ago. We know of no other gage that is comparable.

All PMCo Titanium Thread Ring Gages are numbered and registered and the record kept by us for your convenience.

THE PIPE MACHINERY COMPANY
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

● For full details, write for our pamphlet, "Solid Titanium Carbide Thread Ring Gages."

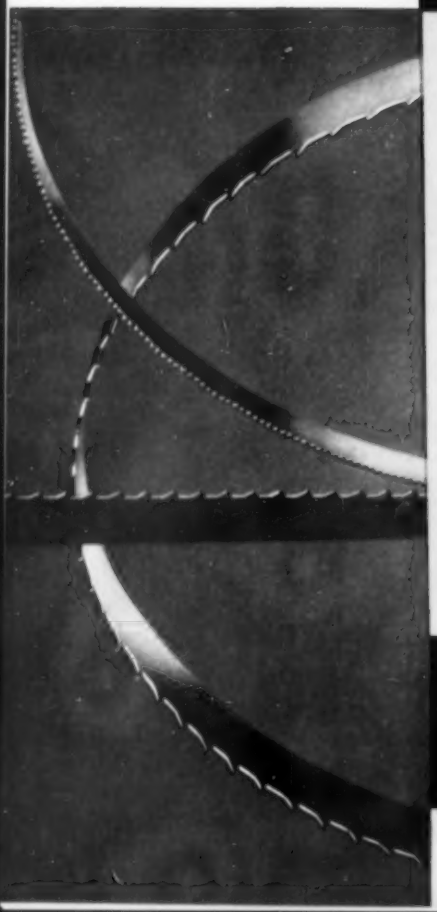
Name _____
Company _____
Title _____
Address _____
City _____ Zone ____ State _____

Great in its day...

BUT WOULDN'T YOU
RATHER HAVE
THE LATEST
TECHNICAL ADVANCE?

Now! An important new improvement in metal cutting

Heller "Job Tempered" Metal Cutting Band Saws



Certified by American Standards Testing Bureau* to meet their standards for Superior Cutting — Uniform Teeth... Uniform Set... Uniform Temper

When band saw machines are equipped with the *right* blade from Heller's brand new line of metal cutting band saws they give exceptionally fast clean cuts — at minimum unit cost — on a wide variety of materials and for long service periods.

Users report these better results because *every* Heller blade is JOB TEMPERED. Steel of a special controlled-analysis specified by Heller metallurgists, is heat treated by a unique process *matched to the steel.* This insures uniform temper and cutting qualities that mean unsurpassed performance on the job.

Teeth are made uniform in size, shape and spacing by machines of specialized design — the most modern in the industry.

Uniform set is made absolutely *certain* by a highly sensitive indicator developed for just this purpose.

Because of these improvements in the art of band saw manufacture, American Standards Testing Bureau gives its assurance that Heller's great new line of saws meet their standards for superior cutting:
uniform teeth — uniform set — uniform temper.

Why not put these exceptional blades to work earning for you?

* AMERICAN STANDARDS TESTING BUREAU INC. ASTB

HELLER TOOL CO. SINCE 1836

Heller

HELLER TOOL CO., *America's Oldest File Manufacturer*
Newcomerstown, Ohio — A Subsidiary of Simonds Saw and Steel Co.

YOU GET THESE HELPFUL EXTRAS WHEN YOU USE HELLER BLADES

SOLD *EXCLUSIVELY* THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"
Heller *"Job Tempered"* Tools

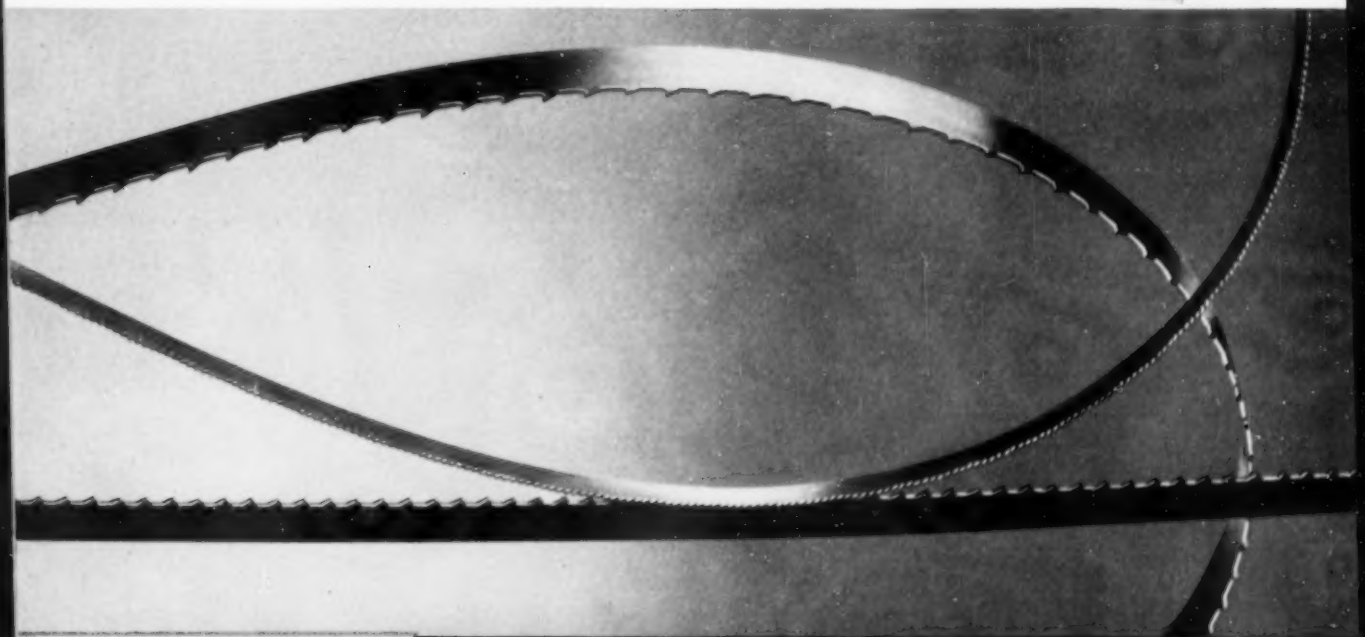
1. COMPLETE SELECTION Heller offers a full selection of "Job Tempered" Metal Cutting Band Saws. You can choose exactly the right tooth shape, set, and blade width in standard or high speed steel as required for your application.

2. CHARTS AND BOOKLETS FOR USERS Your Heller Distributor will furnish you with wall charts and booklets to help you choose the *right* Metal Cutting Band Saw for your applications. These visual aids will show you the speeds and feeds required for best cutting results, for contour cutting or cutoff work.

3. CONVENIENT PACKAGING Heller's packaging is designed for maximum user convenience. Blades come in bulk lengths of 100′ and 250′ coils so you can cut and weld the length you need when you need it. Or individually packaged blades are furnished cut and welded to fit all standard machines.

HERE ARE THE FACTS! Heller's new catalog of "Job Tempered" Metal Cutting Band Saws contains descriptions of all types of blades, tooth shapes, set, applications.

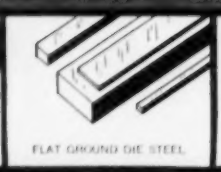
WRITE FOR YOUR COPY TODAY!



nucut

- Hand and Power Hack Saw Blades
- Flat Ground Die Steel
- Famous Heller Files

HACK SAW BLADES


FLAT GROUND DIE STEEL

FAMOUS HELLER FILES

Only
"MAGNAMATIC"
SCREWDRIVERS—

- Control Torque—Control Noise.
- Completely disengage the instant the fastener is run to desired tightness.
- Do not require readjustment to hold torque value.

28-MONTH SERVICE RECORD

Chicago Pneumatic

Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines • Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

TESTED BY TIME —ON THE LINE!

PROVES "MAGNAMATIC" IS...

FIRST in reducing work spoilage

FIRST to eliminate clutch buzz that adds to tool maintenance

FIRST to overcome exhaust noise

Air-driven "Magnamatic" is the *only* Controlled-Torque screwdriver-nutrunner to prove itself in over two years of "on the line" service. In hundreds of applications, Magnamatic "One-Shot" Screwdrivers are used where proper tightness is all-important in eliminating stripped threads, sheared fasteners, damaged parts. Tell us your fastener problem. There are 13 models of "Magnamatic" to help you step up production and reduce fastening costs.

Capacities: #4 screws to ⅜" bolts.
Reversible and non-reversible types.

Chicago Pneumatic Tool Company, Dept. M-47
8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories."
☐ Please send me "Magnamatic" Bulletin SP-3126.
☐ Have representative call.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY
ABERDEEN, SOUTH DAKOTA

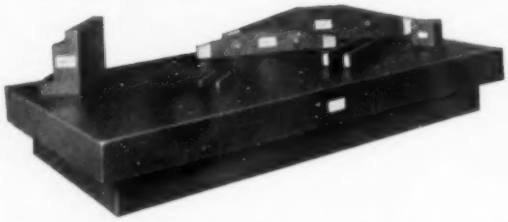
USE READER SERVICE CARD: INDICATE A-3-344-1

COLLINS

MICROFLAT®

BLACK GRANITE

- SURFACE PLATES
- ANGLE PLATES
- STRAIGHT EDGES
- LAYOUT PLATES
- PARALLELS
- T-SLOTTED PLATES



COLLINS MICROFLAT surface plates and precision accessories offer the user extreme accuracy—flatness in millionths!

All sizes—Write for bulletins.

- ☐ FREE Souvenir Paper Weight
- ☐ Microflat Technical Manual
- ☐ How To Calibrate Plates
- ☐ Black, Pink, and Grey Granite Compared

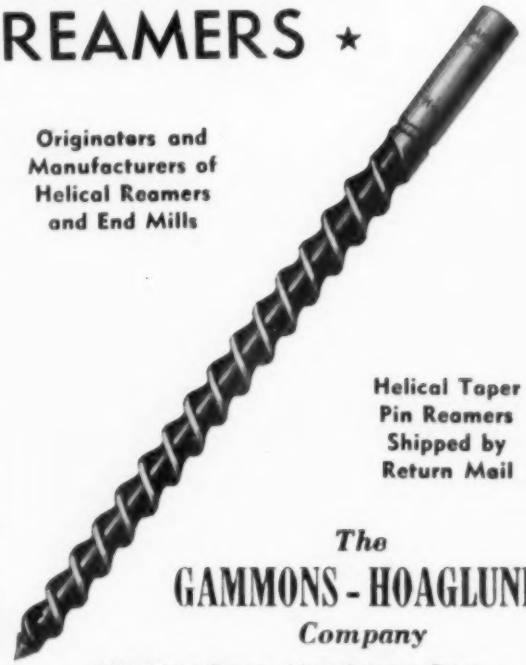
CHECK DESIRED ITEMS AND MAIL WITH YOUR NAME & ADDRESS

COLLINS MICROFLAT COMPANY, INC.
3249 W. El Segundo Blvd., Hawthorne, (Los Angeles County) Calif.
Phone: OSborne 5-4436

USE READER SERVICE CARD: INDICATE A-3-344-2

GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills

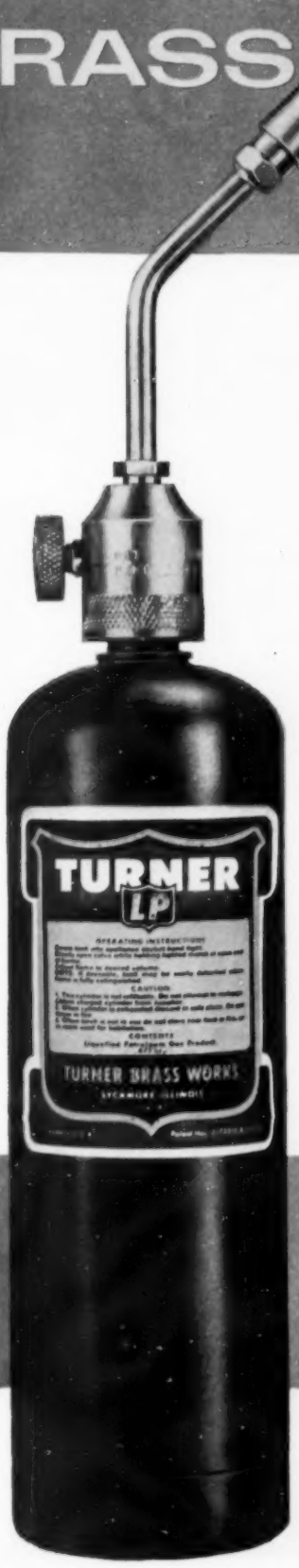


Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS - HOAGLUND
Company
400 Main Street, Manchester, Conn.

USE READER SERVICE CARD: INDICATE A-3-344-3

BRASS keeps sales up... manufacturing costs down



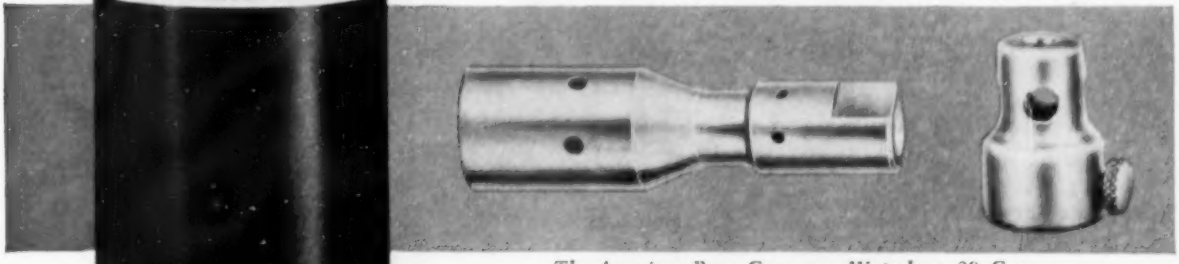
TURNER IS A LONG-TIME USER OF ANACONDA BRASS ROD AND TUBE— GIVES 10 REASONS WHY—

Blow torches built by The Turner Brass Works, Sycamore, Ill., have a reputation for dependable operation and long life. Since 1871, brass has been used consistently in their construction and has built a quality reputation for Turner. Turner prefers Anaconda Brass as a quality metal and looks to The American Brass Company as a quality source of supply.

These are the reasons given:

1. Brass is the quality material needed for the service.
2. Brass is easily machined at high speed, with less tool breakage—manufacturing costs are 15% lower than with other metals.
3. Close tolerances are easily held with brass.
4. Threading holds well—yet accessories are easily screwed on and off.
5. Brass takes a good finish—polishing is easy and economical.
6. Clean, polished brass products have proven high sales appeal.
7. Brass stands up under alternate heating and cooling.
8. Brass resists corrosion—the torches are used on land and sea, throughout the world.
9. Brass gives superior wear on valve seats.
10. Brass has high public acceptance as a quality material.

Turner liquefied petroleum torch No. LP-555, with disposable fuel tank. Below are accessories of brass—holder for soldering tip and a heavy-duty burner.



The American Brass Company, Waterbury 20, Conn.
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA®

COPPER • BRASS • BRONZE

Bodine

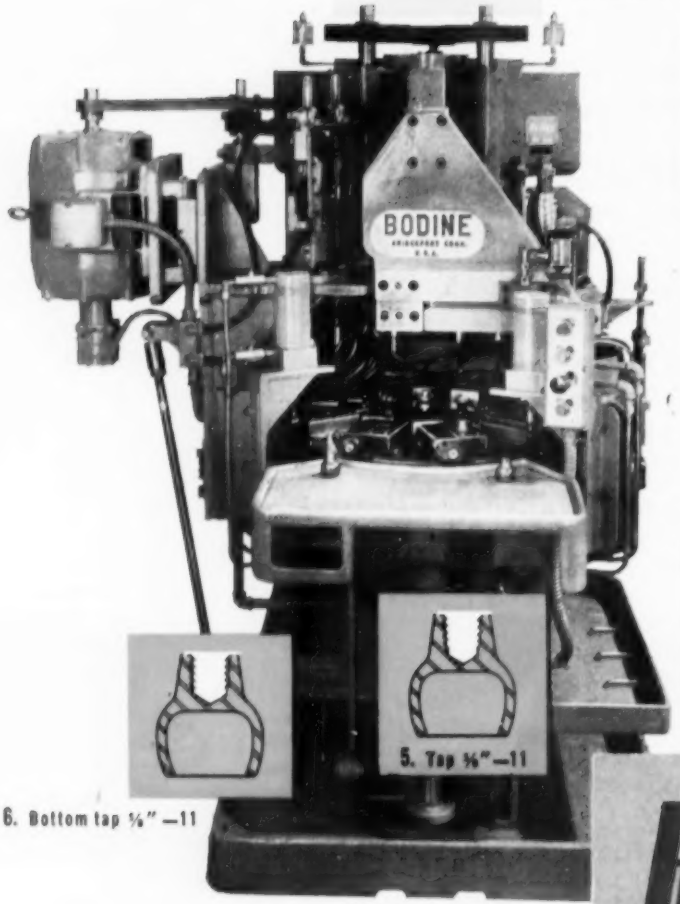
CASE HISTORY NO. 43
a high production success on a "heavy duty" job

Here's an interesting example of how the "extra capacity" built into a Bodine machine can sometimes be put to work very profitably. Ordinarily, ½" drill and tap capacity in steel is maximum for the Bodine 48-30, but in this case we are successfully handling $^{17}/_{32}$" drills and ⅝"—11 taps in an SAE 1025 steel forging on a high production schedule.

Bodine Basic design provides the ample rigidity and mounting space requirements for separate high-power drill and tap spindle drives. Special centralizing clamping fixtures take care of the difficult work-holding problem.

Once again, this proves that the best way to approach any difficult production or combined production-assembly problem of this kind is to call Bodine first.

6 operations
600 pieces/
50 min. hr.



1. Spot drill and chamfer

2. Drill $^{17}/_{32}$" —⅝" deep

3. Bottom drill $^{17}/_{32}$" —¾" deep

4. Face top

5. Tap ⅝"—11

6. Bottom tap ⅝" —11

Write Dept. TE-3
for further information.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

BBD67

If you use carbide cutting tools as much as jet planes use fuel...

This brand cuts down your carbide tool usage, production time and costs!

The more carbide tools you use, the more you need Union

Union manufactures a top quality line of Carbide Cutting Tools, solid or tipped. This includes drills, reamers, cutters, saws, end mills, and "Specials". Available nationally through Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. S. W. CARD DIVISION, Mansfield, Massachusetts, BUTTERFIELD DIVISION, Derby Line, Vermont.

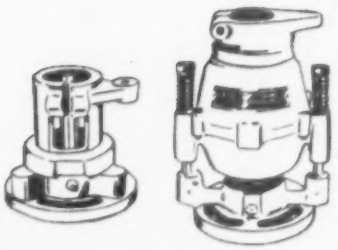
UNION

TWIST DRILL COMPANY, Athol, Massachusetts

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

LET'S PUT OUR MULTIPLE HEADS TOGETHER!

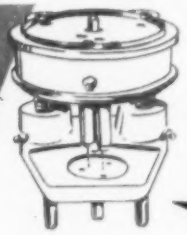
...and plan your small hole drilling and tapping operation on a low cost, maximum production basis

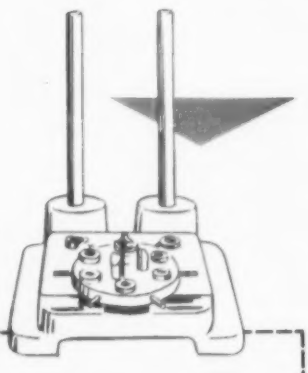


ETTCO-EMRICK
MULTIPLE SPINDLE HEADS

UNIT-ENGINEERED

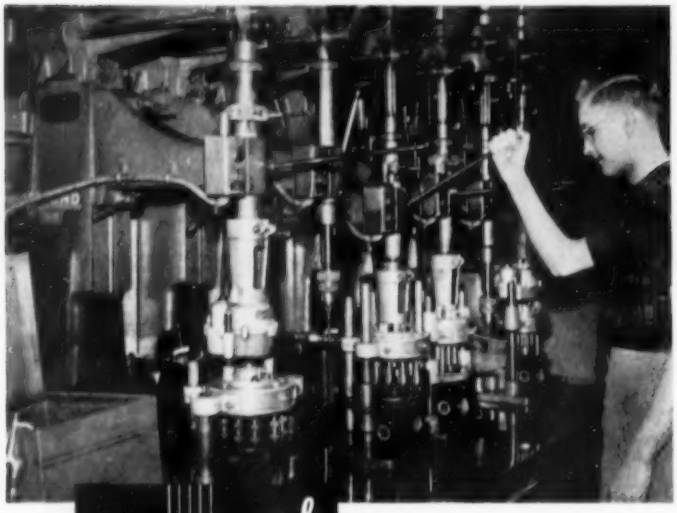
for drilling or tapping on any drill press

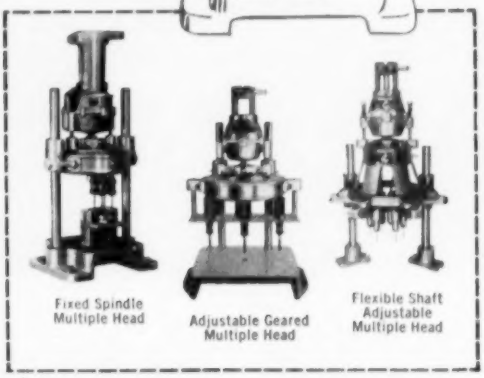




You need the economy and high production attainable only from multiple heads, but no one type will do for *every* job. That is why Ettco makes *all* kinds – fixed spindle, adjustable geared and flexible shaft adjustable – as well as the correct custom tooling for faster handling of the parts. You see, the Ettco "Unit-Engineered" system is a completely integrated service, not just multiple heads with spindles reaching into the air!

There is an Ettco-Emrick multiple head ideally suited to your specific job – easily attachable to your present drill press, tapping machine or automated special. Standardized, reuseable components mean lowered costs, and interchangeable face plates permit a quick switch from tapping to drilling. *Write for our informative catalog now.*





Progressive drilling and tapping with Ettco-Emrick multiple heads and fixtures. Two for tapping and two for drilling convert standard 6-spindle gang drill to a fast production machine. There's a limitless variety of spindle arrangements available so that you can tap or drill 2 to 30 holes at one stroke.

Ettco-Emrick

The only complete line manufacturer of drilling and tapping equipment for the entire small hole field

We'll prove the Ettco story

Which type of Ettco-Emrick multiple head is best for *your* specific application depends on many factors that Ettco specialists can quickly determine.

Send us a sample part or drawings with essential data – We'll submit our recommendations without obligation.

Authorized Ettco distributors throughout the U.S. and Canada

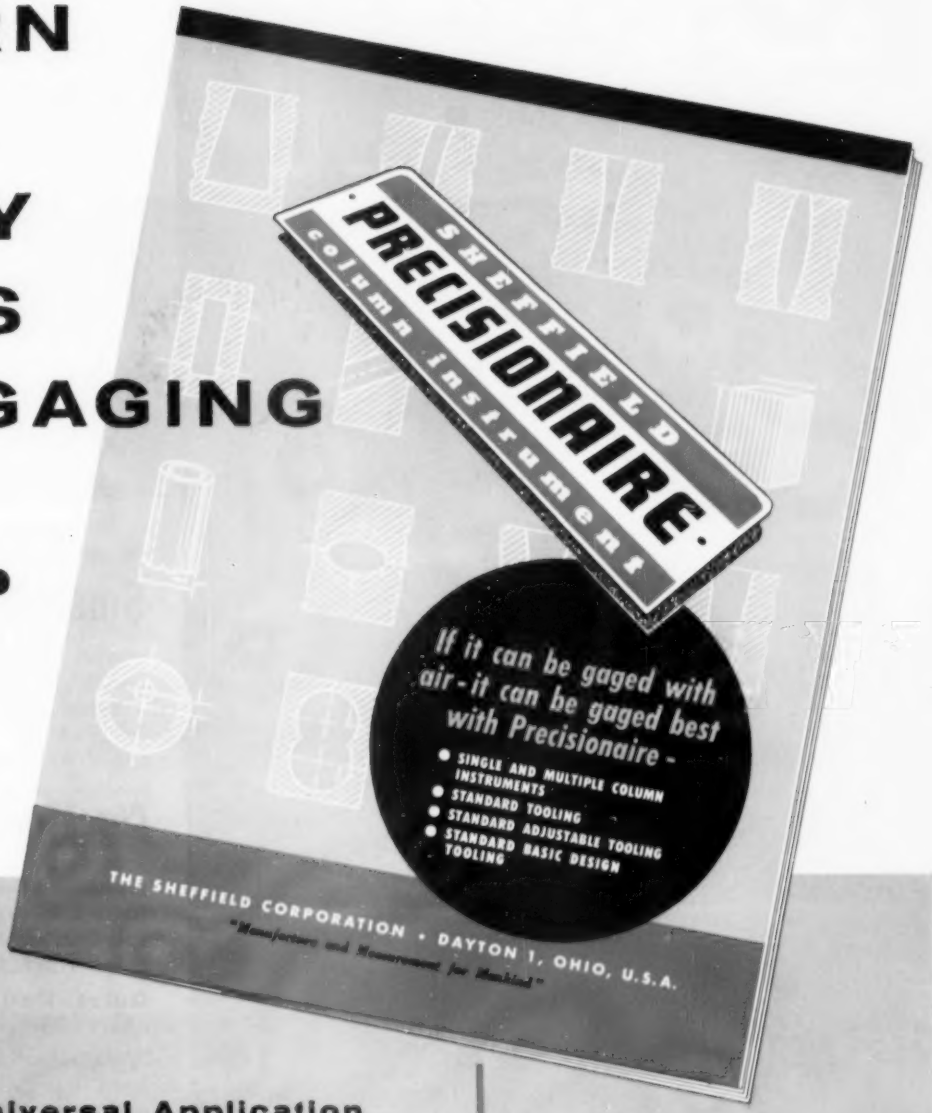
ETTCO TOOL & MACHINE CO., INC.

602 Johnson Avenue, Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

TAPPING ATTACHMENTS • MULTIPLE HEADS • DRILLING & TAPPING UNITS AND MACHINES • SPECIAL MACHINES • INDEXING FIXTURES • TAP & DRILL CHUCKS

LEARN THE MANY WAYS AIR GAGING CAN HELP YOU


SHEFFIELD
PRECISIONAIRE
column instrument
If it can be gaged with air-it can be gaged best with Precisionaire -
SINGLE AND MULTIPLE COLUMN INSTRUMENTS
STANDARD TOOLING
STANDARD ADJUSTABLE TOOLING
STANDARD BASIC DESIGN TOOLING
THE SHEFFIELD CORPORATION • DAYTON 1, OHIO, U.S.A.

- Its Universal Application
- Its Significant Economy
- Its High Order of Precision
- Its Flexibility
- Its Consistent Performance
- Its Method of Operation

Write for this NEW BULLETIN - IPC 6-56

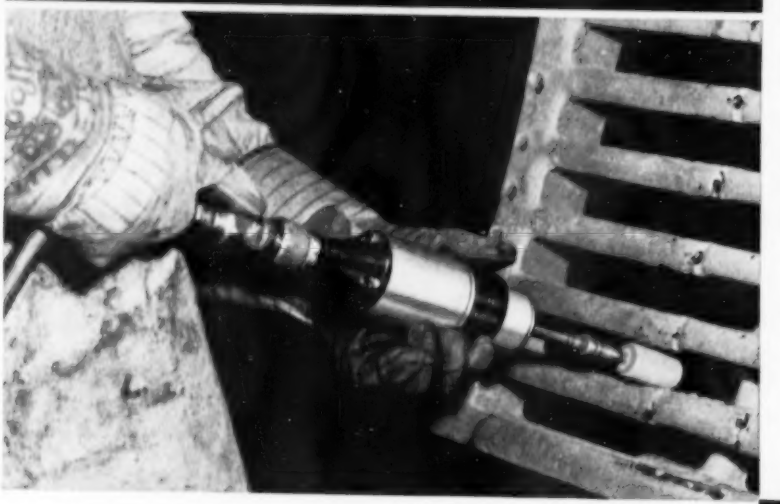
To the Sheffield Corporation,
Dayton 1, Ohio,
U. S. A. Dept. 19

the **SHEFFIELD** *corporation*

7718

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-349

NEW ROTOR "170" series Small-Wheel Air Grinders



Check these features:

Governed for top production. Runs at best practical working speed for *maximum power.* Available in 17,000, 12,000 or 8,000 rpm.

Quiet. Designed for quiet operation.

Wide selection. You can select from over 150 different combinations of speeds, spindles and throttles to do *your* job.

Ask the Rotor Application Engineer for a demonstration on your job. Bulletin 59 free on request. The ROTOR TOOL Company, Cleveland 32, Ohio.

Here's the RIGHT TOOL for YOUR job!

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO

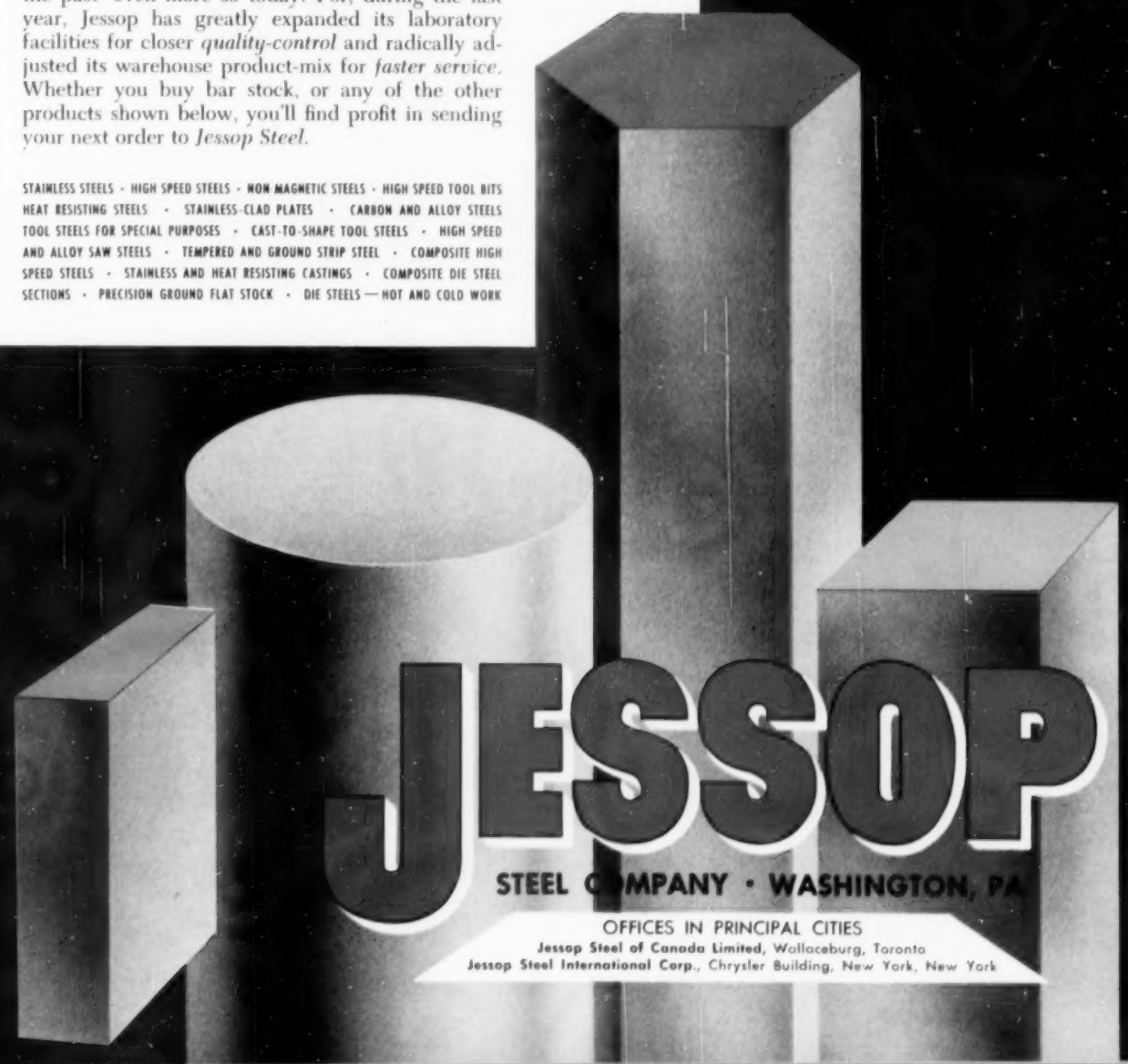
JESSOP STEEL*

HIGH QUALITY*

GOOD SERVICE*

* *High quality* and *good service* are apt words to describe what you get when you buy tool and high-speed bar stock from *Jessop Steel*. Descriptive in the past—even more so today! For, during the last year, Jessop has greatly expanded its laboratory facilities for closer *quality-control* and radically adjusted its warehouse product-mix for *faster service*. Whether you buy bar stock, or any of the other products shown below, you'll find profit in sending your next order to *Jessop Steel*.

STAINLESS STEELS · HIGH SPEED STEELS · NON MAGNETIC STEELS · HIGH SPEED TOOL BITS · HEAT RESISTING STEELS · STAINLESS-CLAD PLATES · CARBON AND ALLOY STEELS · TOOL STEELS FOR SPECIAL PURPOSES · CAST-TO-SHAPE TOOL STEELS · HIGH SPEED AND ALLOY SAW STEELS · TEMPERED AND GROUND STRIP STEEL · COMPOSITE HIGH SPEED STEELS · STAINLESS AND HEAT RESISTING CASTINGS · COMPOSITE DIE STEEL SECTIONS · PRECISION GROUND FLAT STOCK · DIE STEELS—HOT AND COLD WORK



JESSOP

STEEL COMPANY · WASHINGTON, PA.

OFFICES IN PRINCIPAL CITIES

Jessop Steel of Canada Limited, Wallaceburg, Toronto

Jessop Steel International Corp., Chrysler Building, New York, New York

Investigate Production Savings

made possible by Denison's 1-Ton Multipress

No scrap Riveting electrical controls in bakelite cases with the 1-ton Multipress has virtually eliminated breakage for Therm-O-Disc, Inc., Mansfield, Ohio. The press ram automatically reverses when the pre-set pressure of 900 pounds is attained.

Twice the output Three 1-ton Multipresses are used for broaching, burnishing and stripping operations at Lamson & Sessions, Cleveland, Ohio. Production was doubled over previous methods; pinpoint accuracy is obtained with semi-skilled operators.

Higher quality Peening studs less than ¾" long was a ticklish job made easy by the 1-ton Multipress. Health-Mor, Inc., Cleveland, Ohio, manufacturer of vacuum cleaner parts, has found that ease of Multipress operation greatly improves product quality.

Let Multipress point the way to production economy

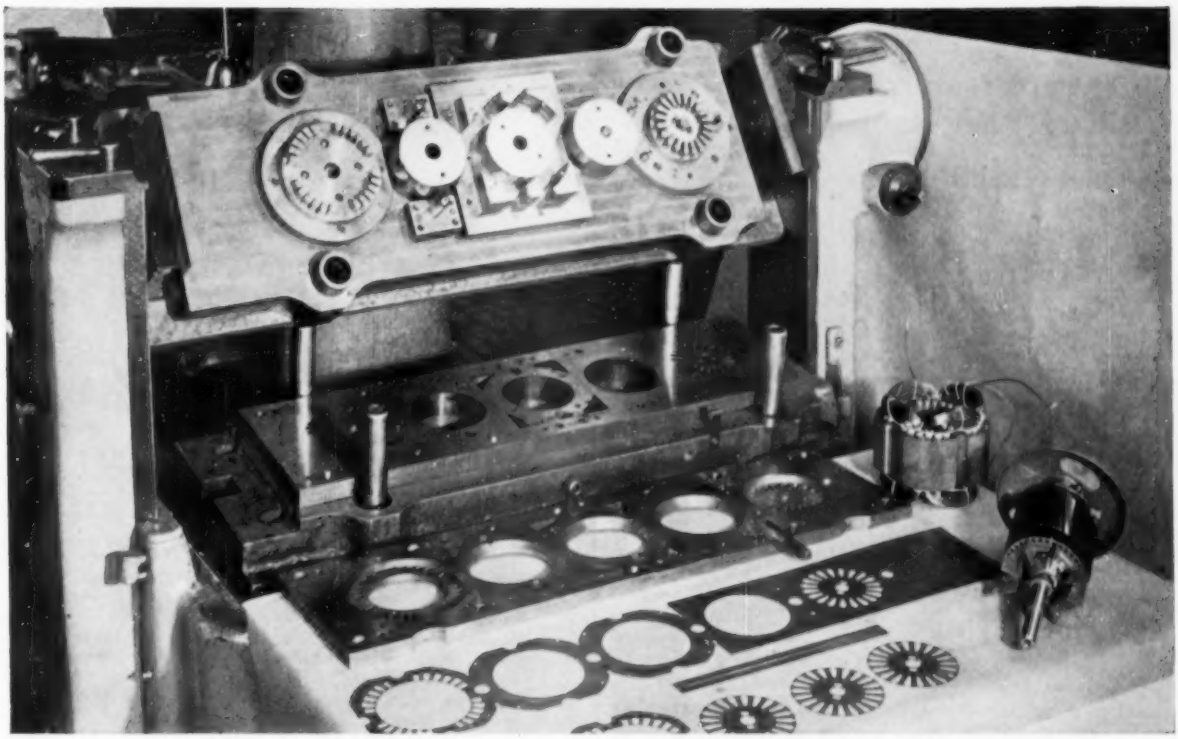
DENISON HydrOILics

For complete information, write:

DENISON ENGINEERING DIVISION

American Brake Shoe Company

1182 DUBLIN ROAD • COLUMBUS 16, OHIO



LIFE magazine selected the Ehrhardt punch and die above to illustrate the Special Feature Series on AMERICA'S ARTS AND SKILLS, Part IX: Beauty in the Tools of Today.

This Ehrhardt die appeared in LIFE magazine ...and here is its "life story"

When a die—even an Ehrhardt die—wins a "beauty rating" in LIFE—that's news. But there's more to *this* success story—*triple plus* tells you how Ehrhardt brought the first precision tooling to the Mississippi—then grew at a rate startling to skeptics in the industry.

The above multi-stage lamination die produces rotors and stators for air conditioning equipment motors. Its complete punch alignment was checked without removing it from this Moore "die Flipper"—one of a complete battery of special machines which guard Ehrhardt's famous precision at each step, and include the latest Elox electrical discharge machining equipment.

If your own tooling ideas encompass even higher orders of precision—if you, too, foresee laboratory exactness soon being demanded routinely—if you'd rather be prepared for tomorrow than caught with your tolerances down—read *triple plus* and be ready.

Ehrhardt/St. Louis accepts and solves problems at a level of difficulty declined by all but an estimated handful of shops in the United States.

Send for the booklet *triple plus* today. Learn how this Ehrhardt concept—full range facilities, plus precision skills, plus unique experience—can add up to a profit story for you.

EHRHARDT TOOL & MACHINE CO., 914 Monroe Street, St. Louis 6, Missouri
Telephone: CEntral 1-5350

A nation-wide service to the few who want the most in high precision gages, dies, jigs and fixtures

Ehrhardt/St. Louis

EHRHARDT TOOL & MACHINE COMPANY
914 Monroe Street, St. Louis 6, Missouri

Please send me a copy of **triple plus**

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

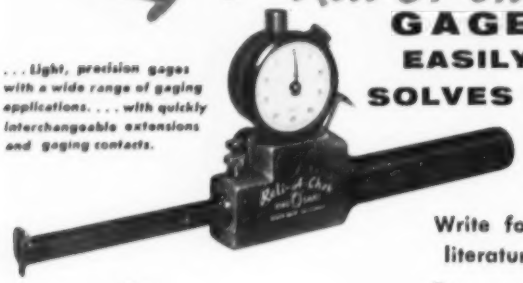
CITY _____

STATE _____

What's your GROOVE *inspection* problem?

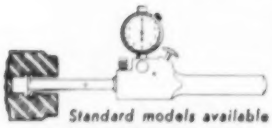
...if it's internal groove diameters a *Reli-A-Chek* GAGE EASILY SOLVES IT

... Light, precision gages with a wide range of gaging applications. ... with quickly interchangeable extensions and gaging contacts.



Write for literature

Gaging recess in blind hole.

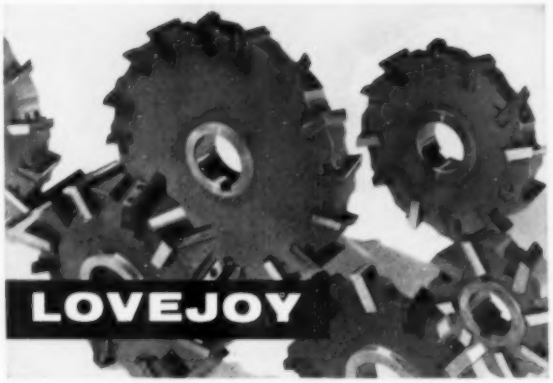


Standard models available for checking "O" ring or snap ring grooves.

R G&S

Reliant GAGE & SUPPLY CO.
4935 FIRESTONE BOULEVARD
SOUTH GATE, CALIFORNIA

USE READER SERVICE CARD; INDICATE A-3-354-1



NEW Type "Z" Milling Cutters

Staggered Tooth Slotting Cutters

HSS Vasco Supreme Gashed Type Blades — Blades are serrated to allow radial adjustment

Wedge Lock — Wedge allows continuous axial adjustment

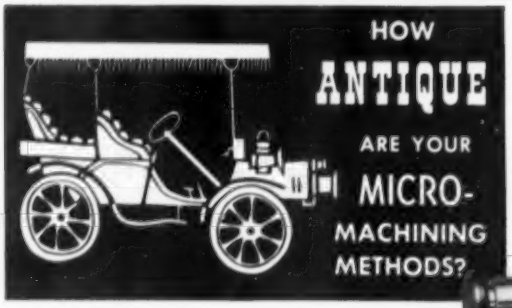
HSS Vasco Supreme Double Handed, Double Serrated Blades — Can be used in either right or left hand position. Serrations allow both axial and radial adjustment

Double Set Screw Lock for Added Rigidity — A smaller double set screw lock is used for narrow widths and smaller diameters

Half Side and Interlocking Cutters — Extra Blade Length to accommodate all applications

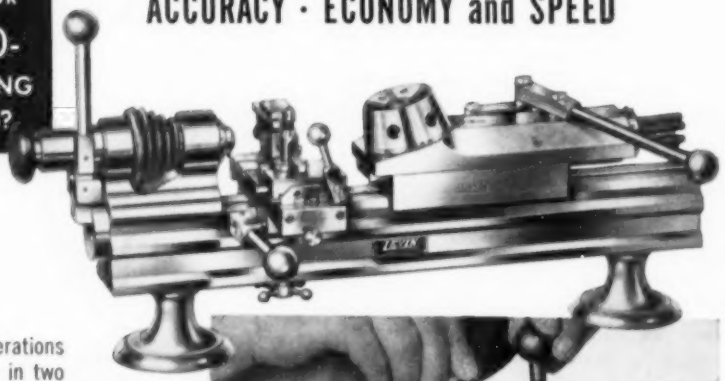
Write for Catalog No. 35

LOVEJOY TOOL COMPANY, INC.
131 Main Street, Springfield, Vermont, U. S. A.
USE READER SERVICE CARD; INDICATE A-3-354-2



HOW **ANTIQUE** ARE YOUR MICRO-MACHINING METHODS?

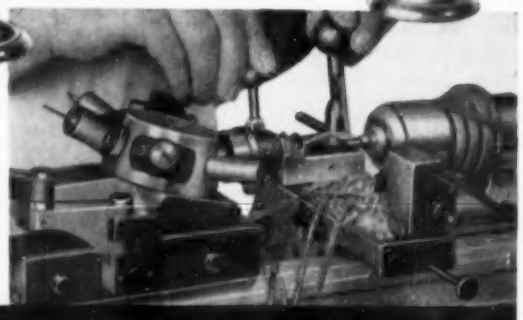
YOU CAN PRODUCE SMALL INSTRUMENT PARTS WITH MORE
ACCURACY · ECONOMY and SPEED



LEVIN ® TURRET LATHES

A small precision turret lathe for second operations and production of instrument parts. Available in two collet capacities, 5/16" or 3/16". The 6 position turret is self indexing and has hardened ways. Turret holes are 1/2" diameter. Turret travel 1-5/8". The cross slide has a swivel side at one end and a rigid tool block at the other. Lever collet closer provides quick opening and closing. A variety of turret tools with 1/2" shanks is available.

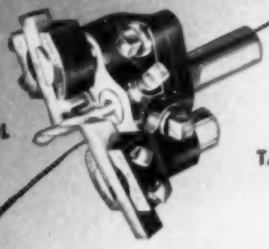
Send for catalog M describing complete line of instrument lathes, micro-drilling equipment and accessories.



LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA

THE R and L LINE SAVES TIME

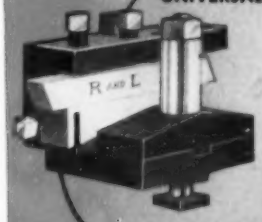
KNURLING TOOL



TURNING TOOL

TAP AND DIE HOLDERS

FLOATING DRILL HOLDER



UNIVERSAL TOOL POST

RECESSING TOOL

Here's how R and L TOOLS pay for themselves

These tools have been described as "tools a *particular* machinist would design for himself". Famous throughout the world for their time and labor-saving features . . . their durability . . . their quality, R and L TOOLS are truly masterpieces of the toolmaker's art.

- Speed Set-up Time
- Speed production
- Reduce rejects to absolute minimum

Write for new catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

R and L TOOLS
1825 Bristol Street, Philadelphia 40, Pa.

☐ Send new catalog
☐ Please have representative call.

NAME .....

COMPANY .....

ADDRESS .....

.....

TR-3

SIMPLIFY MACHINE DESIGN WITH THIS *Different* AIR CYLINDER

Save design time — save production costs. Eliminate cams, levers, gearing, linkages or other mechanical means for performing push, pull or lift motions. Design with air in mind.

The Bellows Air Motor is a complete electrically-controlled air cylinder power unit with directional valve and speed controls built in. It requires only one air connection which can be made with flexible hose. Compact, space saving, it fits well into crowded quarters or on moving machine elements. It is fast, responds to a starting impulse instantly. It is easily interlocked and synchronized with related machine movements. Its quality and reliability has been proven in more than quarter of a million installations.

The range of work it can do is limited only by the imagination of the design engineer.

Send for this free booklet

Here in these quick reading pages is the full story of The Bellows Air Motor — what it is doing for others, what it can do for you. Address Dept. TE-357 The Bellows Co., Akron 9, Ohio. Ask for Bulletin BM-25. In Canada, write Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

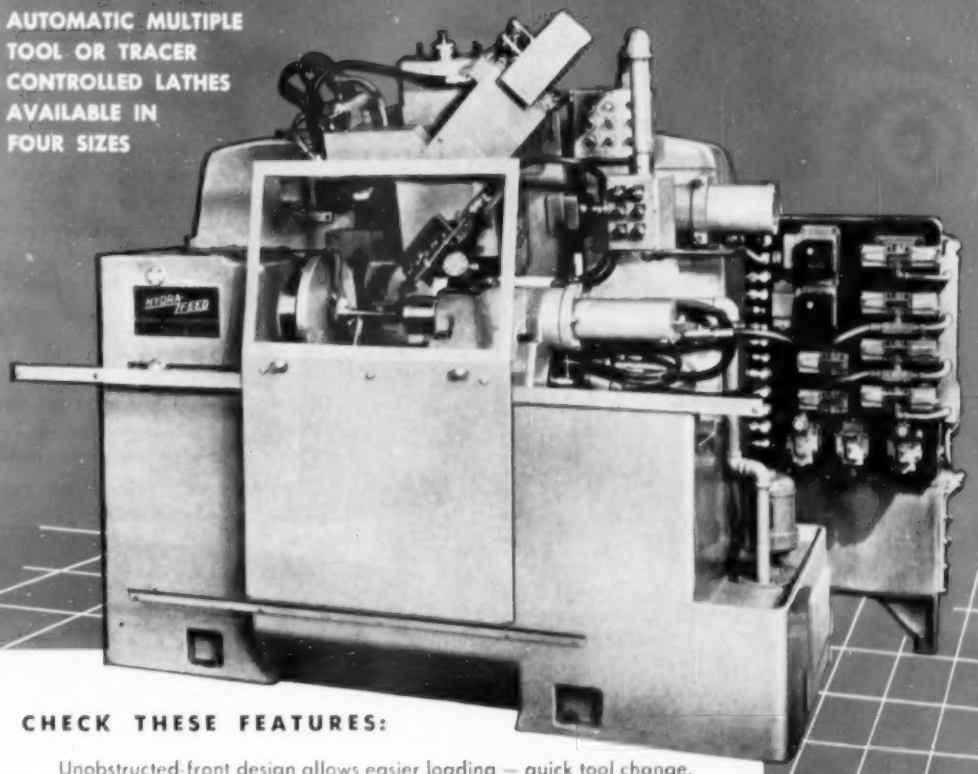
765-B

The Bellows Co.
AKRON 9, OHIO

Buy BULLARD HYDRA-FEED

To Get The Best In Production Lathes

AUTOMATIC MULTIPLE TOOL OR TRACER CONTROLLED LATHES AVAILABLE IN FOUR SIZES



CHECK THESE FEATURES:

Unobstructed-front design allows easier loading — quick tool change.

Massive strength and rigidity with extra power to take full advantage of maximum feeds and speeds.

Hydraulically operated slides may be set to automatically perform any combination or sequence of operations.

For complete details send coupon for catalog *TODAY!*

THE BULLARD COMPANY

286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the

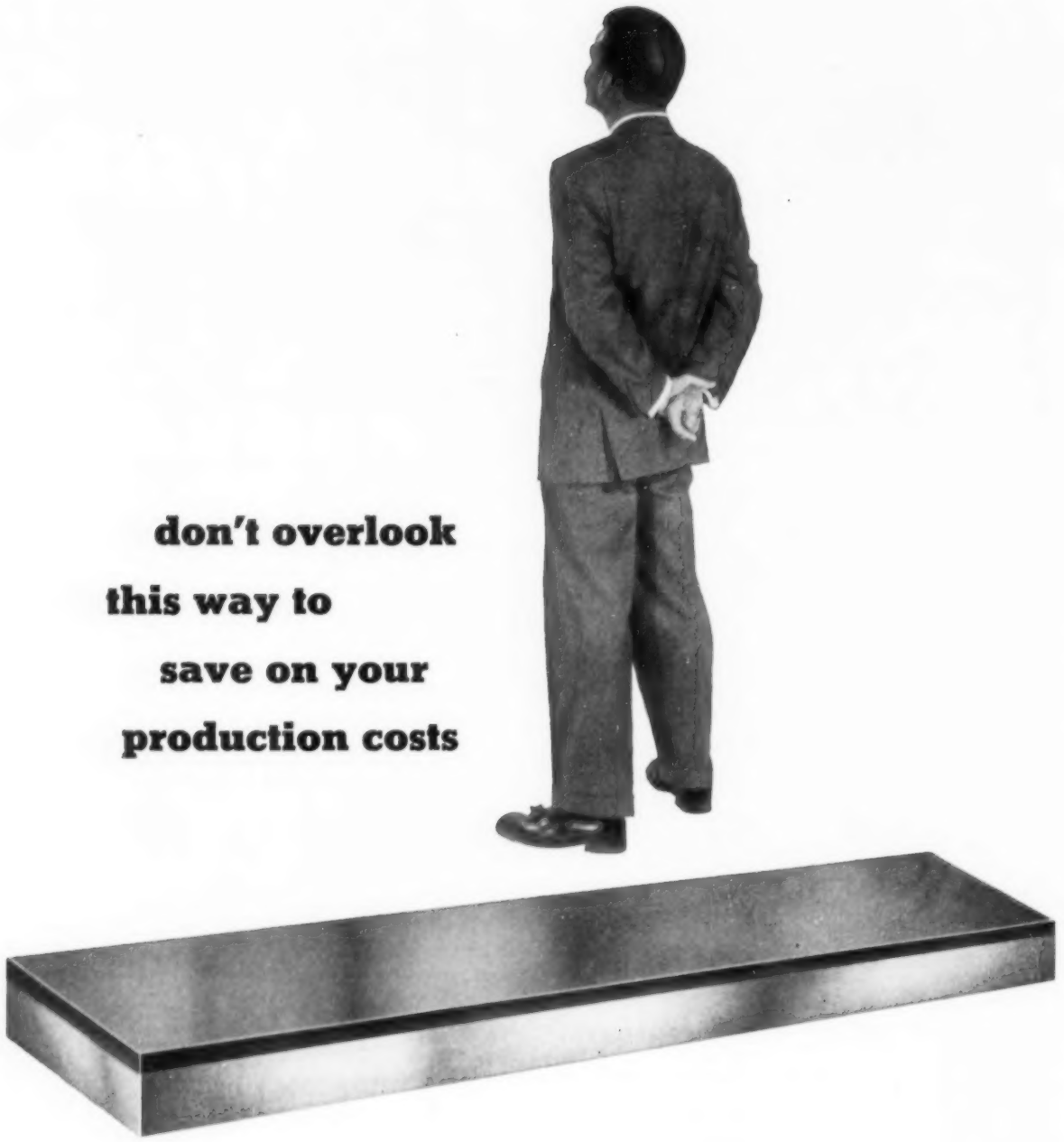
NEW BULLARD HYDRA-FEED LATHE CATALOG

NAME _____

COMPANY _____ POSITION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



don't overlook this way to save on your production costs

OK aluminum bronze wear plates for cam dies are now being used by the majority of appliance builders and automotive body makers. Here's why: You save approximately 40% under the cost of expensive solid bronze wear plates...and you receive completely finished wear plates, available from stock, ground to ± .0005 parallel and flat. By a unique cladding process, long wearing aluminum bronze is bonded to a steel base, easily machinable for fitting to dies. Drilling or counterboring can be done through bronze surface if required. Wherever your die has a sliding or cam action, you'll achieve finer results with OK aluminum bronze wear plates. Complete information is contained in our new OK Catalog. For your free copy, write Dept. 57- U.

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES • SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

GET TRIPLE-ACTION IMMUNOL

(Reg. U.S. Pat. Off.)

The SAFE, LOW COST METAL CLEANER and RUST PREVENTIVE that will do more jobs for you!

Non-flammable, non-toxic, odorless IMMUNOL cleans, degreases and rustproofs metal in one, fast, easy operation. It is widely used as a bucket solvent in metalworking plants to remove cutting oils, drawing compounds, mill dirt, stains, etc. from metal and it can be used over and over again.

IMMUNOL is widely used for these other applications, too:

AS AN ADDITIVE TO SOLUBLE OIL EMULSIONS
IMMUNOL gives cooler work, better tool life, better finishes and additional rust protection

AS A TEMPORARY "IN PLANT" RUST PREVENTIVE
IMMUNOL immunizes against rust for a few days prior to subsequent operations

TO REPLACE SOLVENT AND VAPOR DEGREASING
IMMUNOL will be just as efficient as other solvents. It will prevent rust and operators will like it better since bad odors, skin irritations and the danger of fire will be eliminated

FOR TUMBLING METAL
IMMUNOL is used (1) before tumbling as a cold dip to remove oils (2) as a rust inhibitor in the barrel to stop rust when parts susceptible to rust are being cleaned (3) to replace soap as a cleaner (4) as a dip rinse and rust preventive immediately after tumbling

FOR MAGNETIC PARTICLE INSPECTION
IMMUNOL gives better definition of flaw than kerosene or mineral spirits, eliminates the fire hazard, is odorless and prevents rust

TEST IMMUNOL AT OUR EXPENSE
Write for a free sample today.

HARRY MILLER CORP. HAMICO 4th & BRISTOL STREETS PHILADELPHIA 40, PA.

Manufacturers of STEELGARD, HAMIKLEER, ACTIVOL, HAMICOTE

HARRY MILLER CORP.
Original Products and Processes Since 1936
4th and BRISTOL STS., PHILA. 40, PA.
DAvenport 4-4000
Service Representatives in Principal Cities

The Proof of the Pudding is in the EATING

Constantly
increased sales
of our products
are
the best testimony
of their quality

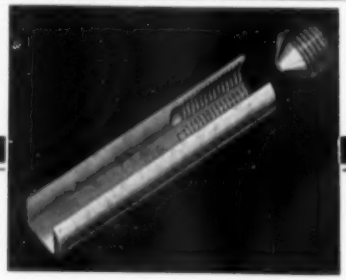
"Honesty, Integrity and Service"
Is Our Motto

General *Industrial Diamond Co., Inc.*

ALgonquin 4-8025 ALgonquin 4-8071

611-21 BROADWAY NEW YORK 12, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-360-1



Novi Square Slotted Sleeves Reduce Tooling Costs

Novi square slotted sleeves provide a simple, quick and inexpensive method of making square holes for installing tool bits in boring bars, tool holders and cutter heads. As shown in the illustration, the sleeve is tapped at one end and is furnished complete with back-up screw. It is simply inserted in a reamed or bored hole and is held in place by a small dowel, or it can be soldered or silver brazed. Ideal for making rectangular as well as square holes.

Sleeves inserted in two-step boring bar

Made in the following sizes for square tool bits:
3/16", ¼", 5/16", ⅜", 7/16", ½", ⅝" and ¾" square

WRITE FOR LITERATURE

NOVI TOOL & MACHINE CO.
25806 Novi Road Novi, Mich.

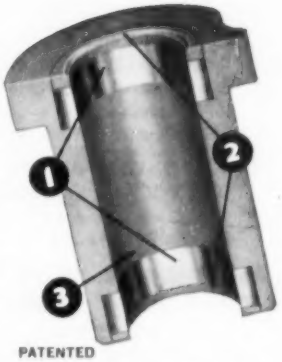
USE READER SERVICE CARD; INDICATE A-3-360-2

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1868

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-3-360-3

PARKER · MAJESTIC pm PRECISION MACHINES

NOW

A COMBINATION INTERNAL/EXTERNAL GRINDER

Combination Machine set up for Internal Operation

PARKER-MAJESTIC *presents the well known Internal and External Grinder shown here as a combination unit.*

- One spindle mounting bracket performs both operations.
- Quick changeover—Loosen only four nuts and swivel bracket 180° to bring spindle into operating position.
- 12″ swing over table.
- Horsepower rating maintained in new totally enclosed motor design; drive pulleys mounted on either end of motor.
- Internal spindle driven by flat belt in conjunction with spring loaded idler assembly of new design.
- External spindle driven by timing belt requiring little belt tension.
- Operator protected by well designed guards.

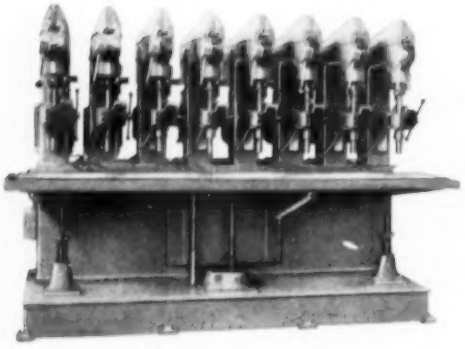
Combination Machine set up for External Operation

PARKER-MAJESTIC, INC.

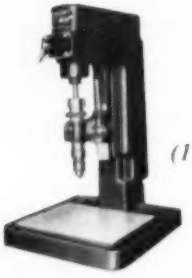
147 Joseph Campau · Detroit 7, Michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-3-361

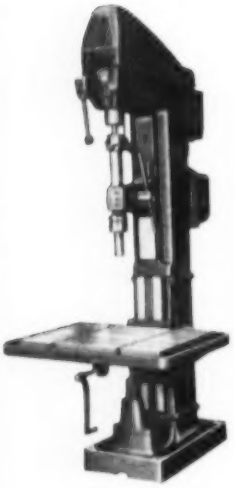
Avey has the right one



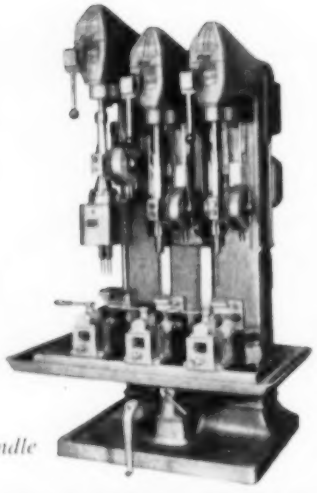
(7) Super 8 spindle



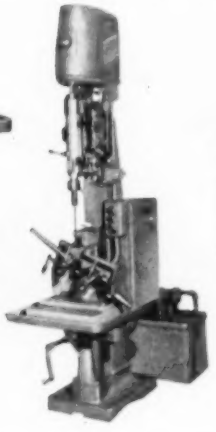
(1) Bench type

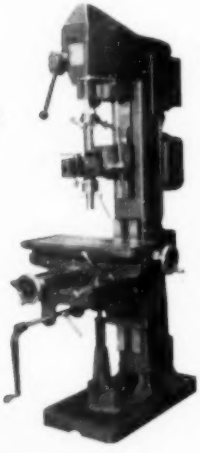


(2) Column type



(3) Multi-spindle





(4, 5, 6) Tool room drills

Whatever your light and medium duty drilling needs, it's a sure bet that the machine you need is made by Avey. The whole Avey line would pack this magazine with pictures—would give you every combination of size, capacity, speed, overhang, and table arrangement to fit your requirements. The ones shown will give you the general idea. Write for literature.

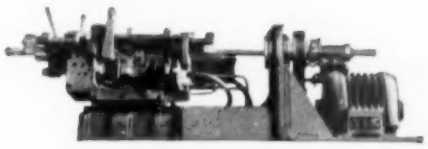
(Figures 1 through 6) Standard Drilling and Tapping Machines. Capacities in cast iron from very small numbered drills to 1½"; 6 or 8 speeds up to 12,000 rpm; No. 32 Jacobs chuck to No. 4 Morse taper; 4 feeds; 1 to 6 spindles; column or bench type; wide range of swing. Featuring such "bonus" advances as micrometer stop collar; telescoping spindle guard; dynamically balanced rotating parts; rack and pinion operated motor plate; large tool and die shop tables; and Avey's pace-setting spindle construction.

(4, 5, and 6) Avey tool room drills, built in No. 2 and No. 3 BMA-6 sizes. Large table 34" x 25"; round table 18" diameter; compound table 25" x 12".

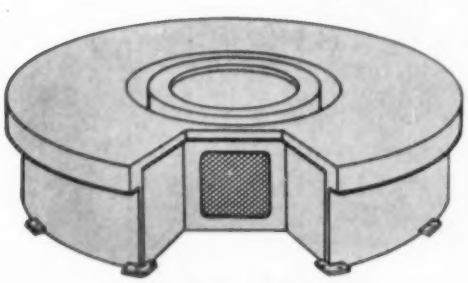
(7) Super 8 Spindle Drilling and Tapping Machine. No. 2 Morse taper. Power lift to table by push button control. Hand feed, power feed, lead screw tapping. Four feeds, 6 speeds. Built-in coolant system.

for Avey makes them all

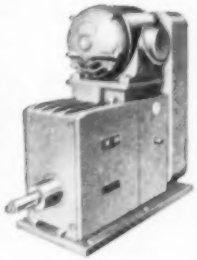
Avey



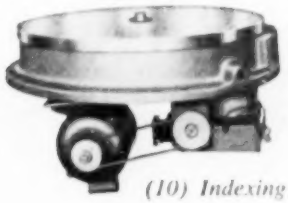
(9) Avey-draulic



(11) Standard base



(8) Cam feed unit



(10) Indexing table

(8) Automatic Cam Feed Units. For drilling, tapping, reaming, hollow milling. Vee belt or gear drive. Nos. 1, 2, and 3 Morse taper. Capacity in cast iron: No. 1, ½"; No. 2, 1". Mount at any angle. Fully or semi-automatic. Self-contained, tamper-proof.

(9) Avey-draulic feed unit. Automatic withdrawal for chip removal only when necessary during deep hole drilling. Rapid advance, feed, and rapid return. Jump feed attachment available. Standard strokes 12" up to 30". Avey's patented Torque-matic control optional.

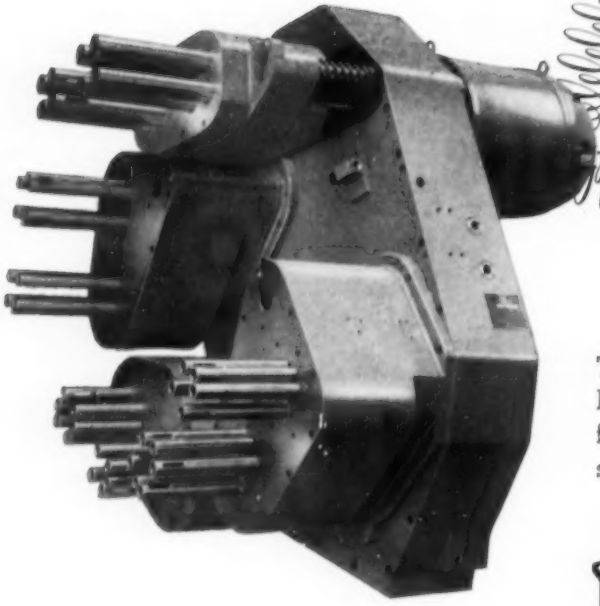
(10) Automatic index tables. Rapid, accurate indexing to .001". Even or uneven index patterns obtainable. 16" to 48" diameter. All adaptable to Avey standard bases.

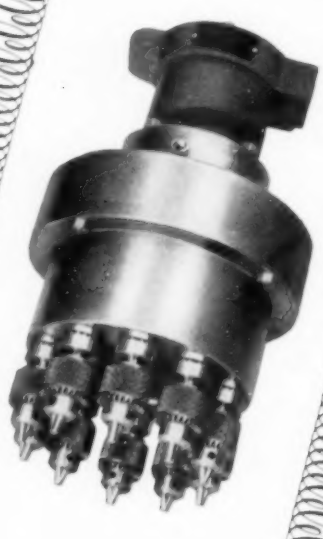
(11) Steel Bases. One of Avey's standard line of fabricated bases. Stress relieved, sandblasted, machined, and painted to fit your application. Combine 8, 9, 10, and 11, and you get fast returns on your investment, and a step ahead of your competition!

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

FROM THEN...
...TO ETERNITY





1924

The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

1957

The 50,000th Head was shipped.

For men who know drill heads best, it's always U. S. Drill Head ...5 to 1

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

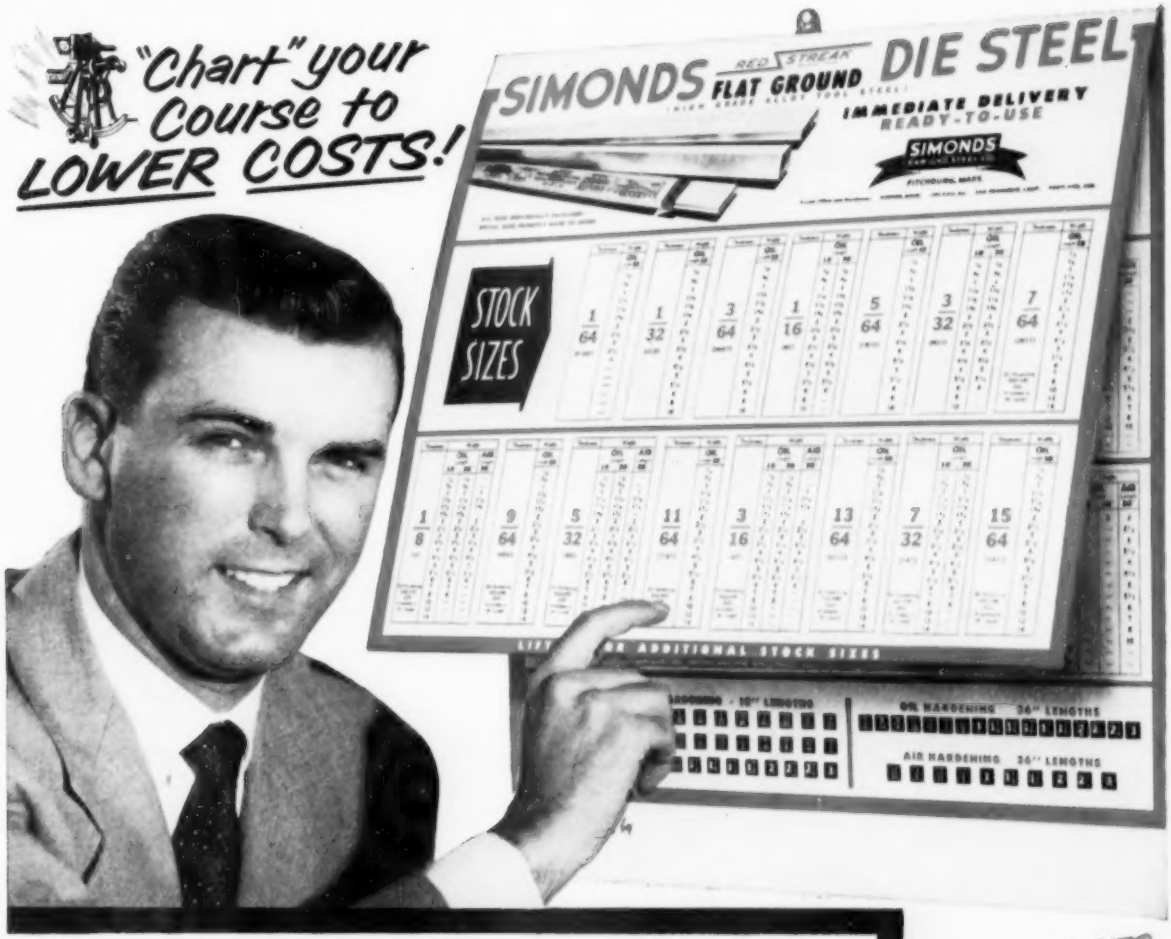
Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-364



Get your copy of Free Wall Chart showing MORE NEW STOCK SIZES of

SIMONDS

Flat Ground

DIE STEEL

(HIGH GRADE ALLOY TOOL STEEL)

Finding or selecting the right size bar of ready-to-use tool and die steel is a simple matter with this specially designed wall chart (19″ x 20″). At your fingertips it shows "1001 sizes for 1001 uses" — flats and squares — including hundreds of newly added sizes . . . all precision ground, packaged and on the shelf ready to save you time, cut your costs and give you consistently better results.

QUICK FACTS

Precision Ground, Ready-to-Use for making Punches, Dies, Jigs, Gages, Fixtures, Templates, Machine Parts, Small Tools and 1001 other uses

Made of High Grade Alloy Tool Steel from Simonds Own Mill

Wide Hardening Range Simplifies Heat-treating — Assures Consistently Excellent Results

Choice of OIL or AIR Hardening Types

Widest Selection of Standard Stock Sizes Ever Offered

For Fast Service from Complete Stocks

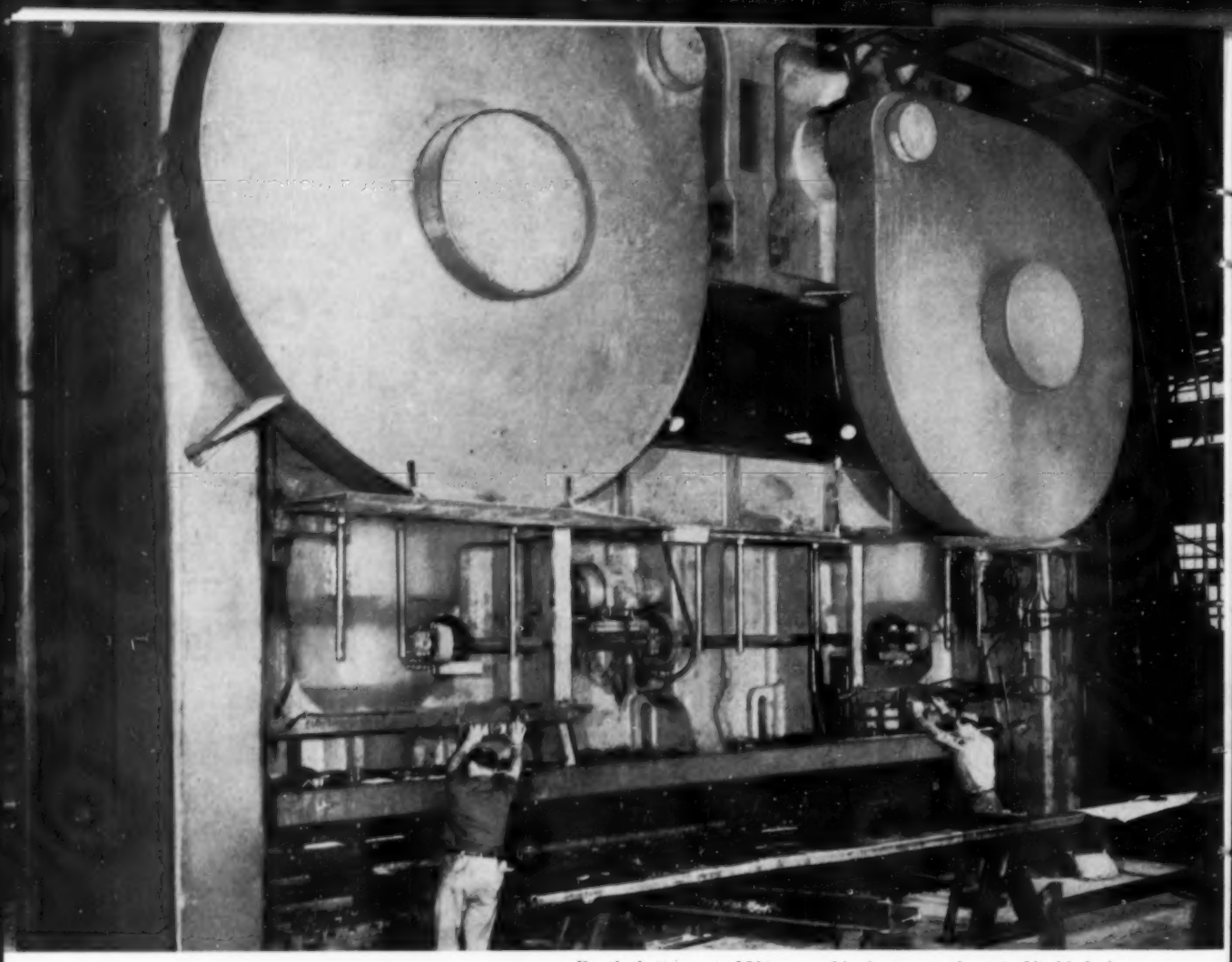
Call your SIMONDS Industrial Supply DISTRIBUTOR

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada • Heller Tool Co., Newcomerstown, Ohio

125 years of growth 1832-1957

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.



For the better part of 3½ years, this giant press—largest of its kind—has operated three shifts a day, seven days a week, doing with a single hit what formerly required two forming operations on a 3000-ton press.

4000-ton Hamilton press produces formed truck and bus rails from flat blanks in a single hit

By producing completely formed side rails from flat blanks in a single operation, this press has eliminated costly and time-consuming die changes, storage of partly formed rails between operations, and attendant materials handling problems. It does not give camber, or bow, to the rails and so this huge Hamilton press has eliminated the need for intermediate and final straightening operations.

Simplicity of lubrication is an important factor in the successful operation of this press. A special system, built in during installation, results in positive, efficient oiling of all moving parts with foolproof ease.

For all its 4000-ton capacity, the press weighs only 900 tons, stands only 43 ft. high, and is only 30 ft. 10 in. wide, 12 ft. 10 in. deep. It is driven by a 150 hp motor turning up 1200 rpm. The stroke is 22 in., operating speed is seven hits per minute.

Write to Hamilton Division, B-L-H Corporation, for full information and specifications on the line of Hamilton heavy duty presses.

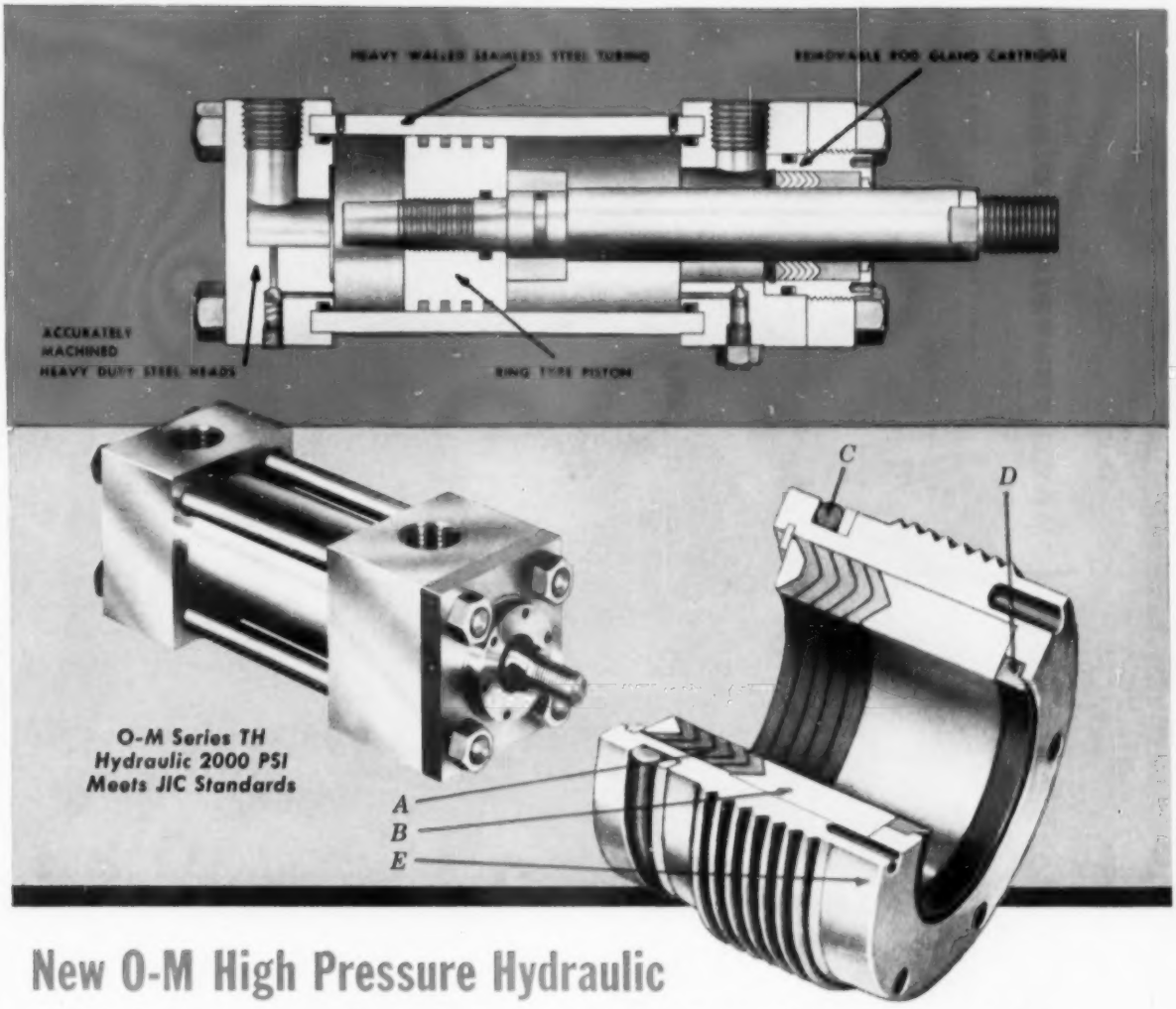
Low-carbon sheet steel side rail blanks up to 26½ ft. long by 3/8 in. thick are fed into the press at the Cleveland Plant of Midland Steel Products Company. The operating crew varies from four to eight men, depending on size of rails being formed.

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical presses • Can making machinery • Machine tools

BALDWIN BLH LIMA-HAMILTON



New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge

The O-M-engineered removable Rod Gland Cartridge, exclusive with the O-M Series TH Hydraulic Cylinders, incorporates all the features essential to peak performance and minimum maintenance. It is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

A ***Rod Packing*** — Vee type, non-adjustable, self-compensating, rod gland packing provides multiple lip seal with excellent pressure sensitivity and long life.

B ***Rod Bearing*** — Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

C ***Cartridge "O" Ring Seal*** — With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

D ***Rod Wiper*** — Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

E ***Pilot*** — O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders — conservatively rated at 2000 P.S.I. — are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are included in the new O-M Bulletin 105. Mail coupon for your FREE copy today.

ENGINEERING SERVICE — consult an Ortman-Miller representative regarding your hydraulic or pneumatic problems. His broad experience with standard and special cylinder applications is available to you without obligation. Use convenient coupon.

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

☐ Have representative call. ☐ Send Bulletin 105.

Name _____ Position _____

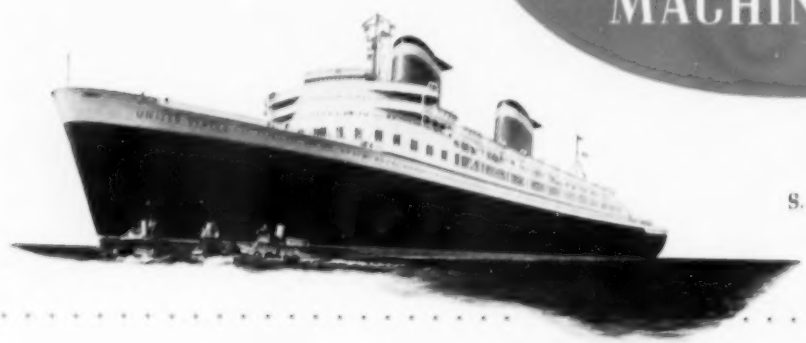
Company _____

Address _____

City _____ Zone _____ State _____

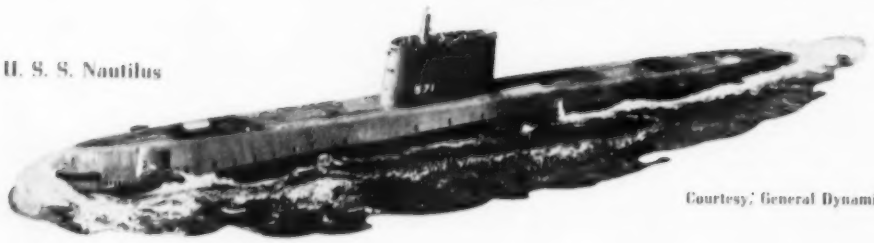
The PRECISION GEARS which Drive these Great Ships were Finished on . . . . . .

RED RING HORIZONTAL SHAVING MACHINES



S. S. United States

U. S. S. Nautilus



Courtesy, General Dynamics Corporation

U. S. S. Forrestal

Red Ring horizontal rotary shaving machines were used by Westinghouse Electric Corporation to finish the main propulsion gears of these great ships and many others.

Rotary Shaving assures precision in external and internal gears of all sizes. Write for information on your gear problems.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

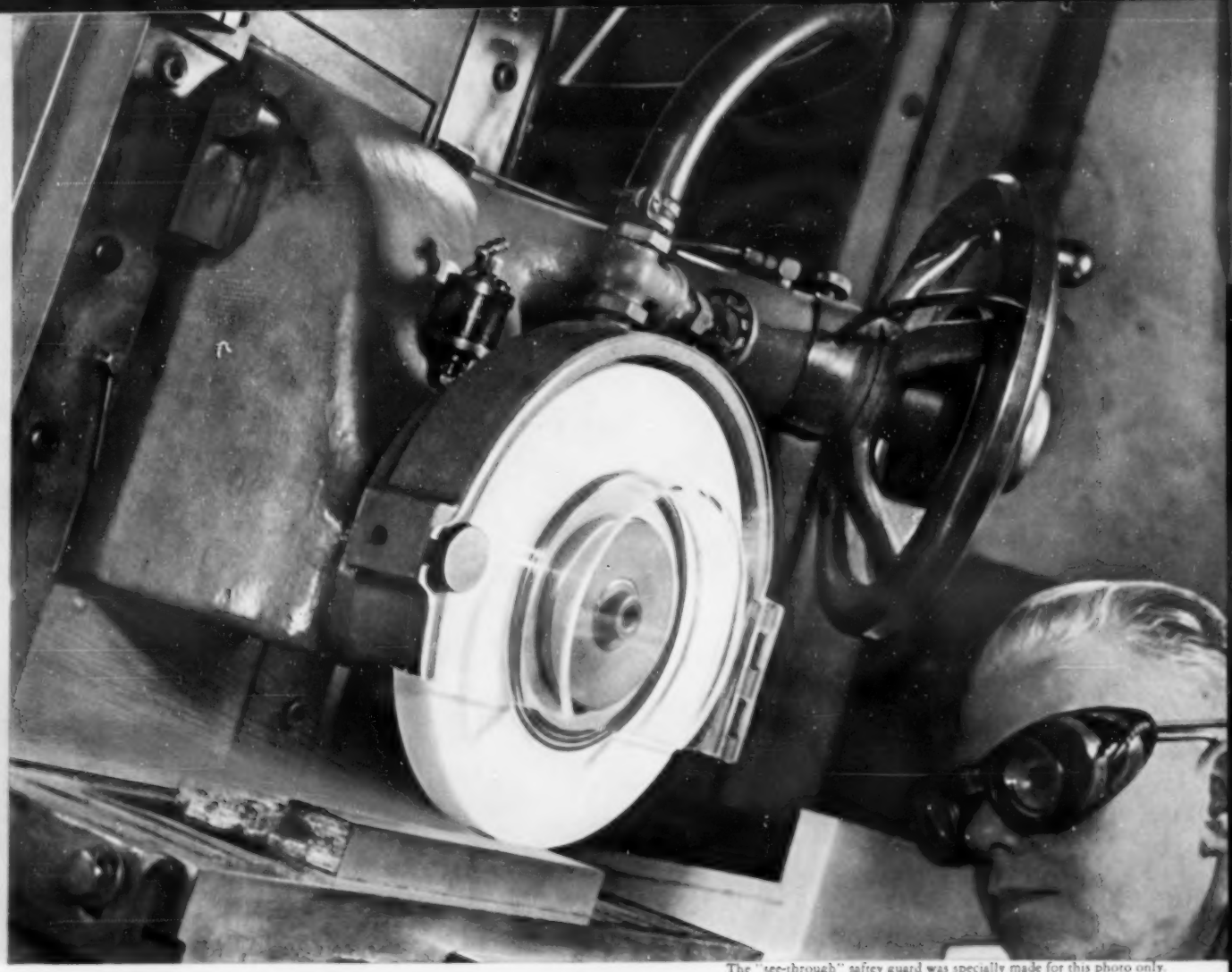
5600 ST. JEAN • DETROIT 13, MICHIGAN

7693

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

IMPORTANT: For your convenience this sheet is perforated. Tear it out and "buck-slip" it to the proper man in your plant.

Here's the famous V40 Tool Room Wheel in action! Two years of proven industry-wide supremacy have made these V40 wheels "a must" in tool room operations. Check the case history on the back of this page.



The "see-through" saftey guard was specially made for this photo only.

Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **BONDED ABRASIVES DIVISION**

Also makers of a complete line of Coated Abrasives and Abrasive Grain

ATTENTION TOOL ROOM FOREMAN: Turn the page and see the Product Performance Report written especially for you.

Product Performance Report

SURFACE GRINDING HIGH CARBON STEEL

Operation

1. Surface grind to size high carbon, high chrome plunger.

Project

2. Grind, from the solid, in one operation a radius and flat slot in the same mold plunger.

Results

Select wheels to grind without burning or checking the plunger that will produce a fine M. I. finish at a fast production rate.

1. AA46-H8-V40 surfaced the plunger to a total indicated flatness and parallelism of .0002" maximum, generated a finish of 10 M. I. and produced a uniformly appearing surface that was entirely free from burn and check. The grinding done at these speeds and feeds—

INFEED	CROSSFEED	TABLE SPEED
.003" per pass	1/32"	50 F. P. M.

2. AA46-H8-V40 on a wet operation ground the complex radius and flat slot from the solid and removed a depth of .376" in 16 minutes. The form was free from burn and check and measured a maximum of 10 M. I. in roughness.

Note

Carborundum, leader in abrasive techniques, backs up its products with trained sales representatives, a staff of competent field engineers and an abrasive engineering laboratory ... all available to you to put more sense in your abrasive dollar.

Here is another in the series of Product Performance Reports being released by the Bonded Abrasives Division of The Carborundum Company. A color photograph of this actual operation is shown on the back of this page.

• *Ask your local distributor... or the man from*

CARBORUNDUM

REGISTERED TRADE MARK

PRINTED IN U.S.A.

Another Bath Taps job well done... for CONTINENTAL MOTORS

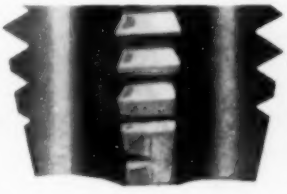
Bath Taps are used for accurate threading operation on the crankshaft flange of the JD382 Continental Red Seal diesel engine.

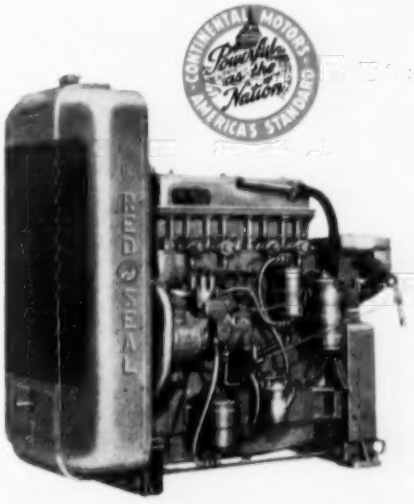
Skilled workmanship — plus the use of modern equipment and the best quality tools, maintains a high standard of production at the Muskegon plant of Continental Motors Corporation -- where Red Seal diesel and gasoline engines are built for transportation, construction, farm and industrial use.

Selection of Bath Taps for threading Red Seal parts is proof of their dependability — since accuracy in the machining of components makes a big difference in the smooth operation of these powerful Continental engines . . . many of them, custom-built for special use.

In addition to taps for every-day, in-line production — Bath has earned a reputation for the design of custom-built taps requiring special creative engineering.

Do you have a threading problem? We'll be glad to put our experience to work for you.





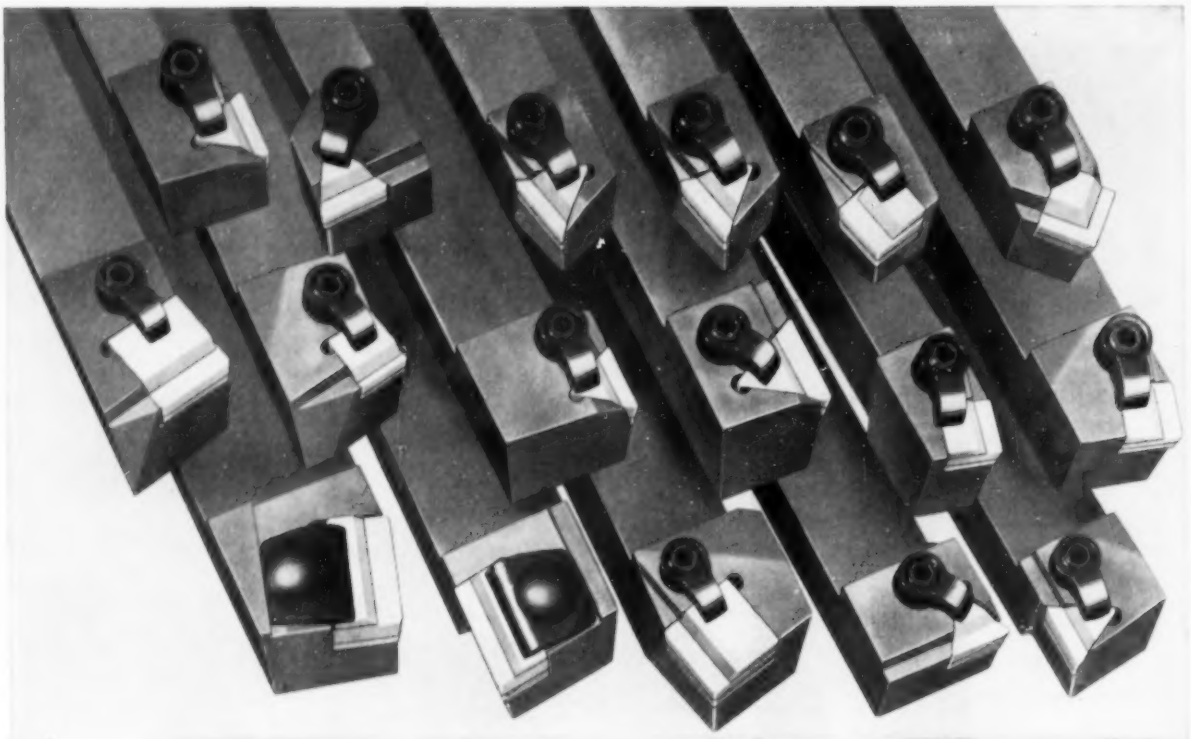
Model JD382 Continental Red Seal diesel industrial engine — built for economy and long life.

JOHN BATH & CO. Inc.

28 Grafton St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS
INTERNAL MICROMETERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-371



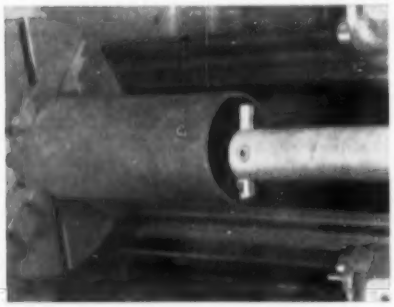
KENNAMETAL*—KENDEX*... the leader in "throw-away" insert tooling

Starting with only six styles several years ago, the Kendex* line of clamped "throw-away" insert type tooling has grown to 27 styles and over 200 tools . . . plus many special designs as illustrated on these pages.

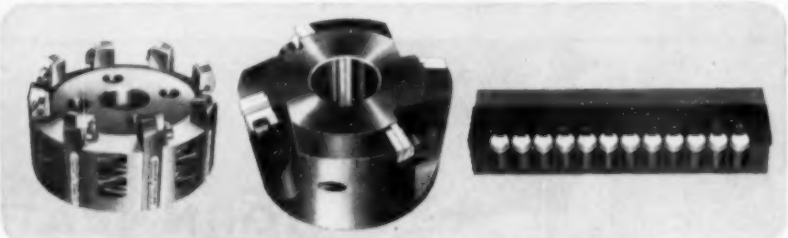
This rapid acceptance of the Kendex principle for more and more machining operations can mean only one thing: Kendex Tooling offers users certain exclusive advantages and a better return on their investment than any other metal-cutting tools available.

Today there are Kendex Tools for practically any metal-cutting operation . . . for use on all types of machines: turret lathes, engine lathes, planers, milling machines and automatic cycling machines. You can have positive or negative rake tools and regular or precision inserts of the right size, shape and grade for top performance on every job . . . for roughing, finishing or interrupted cutting. Every Kendex Tool permits fast indexing of inserts or change of chipbreaker without resetting the tool . . . *eliminates regrinding of inserts and chipbreakers* . . . permits use of harder grades of carbides for higher speeds . . . plus these additional features:

- a wide variety of "throw-away" inserts . . . utility ground (top and bottom) or precision ground (all



Boring bar equipped with standard Kendex indexable inserts (square or triangular), chipbreakers, and insert seats.



Eight standard Kendex Tools adopted for face milling and deep chamfering.

Special 4-insert boring head with adaptation of standard "throw-away" inserts, chipbreakers, shims, and clamp mechanism.

Kendex multiple grooving tool, with 12 turnover inserts. Cutting edges easily indexed—solid Kennametal seats.

surfaces) . . . in round, square or triangular shapes . . . available in eight different grades.

- Solid Kennametal seats are standard on all Kendex holders . . . Kennametal chipbreaker plates optional for all styles.

Now Kendex Boring Bars bring all the advantages of the Kendex principle to turret lathe boring operations

Here are some Kendex advantages on boring operations: the cutting point is brought down to the center line of the bar; greater support of the cutting edge is provided; better chip control; higher speeds for better boring results; greater resistance to thermal shock and to edge wear at higher speeds. Cutting inserts index quickly and accurately without resetting tool thus reducing machine downtime. Costly regrinding is eliminated. Production is increased.

New! Small Kendex Tools for light machining . . . boring

Another variation of the popular Kendex Tooling is the small ½" square by 4½" Kendex holder to use small inserts at a 5° negative rake angle. This is available in four styles for all light machining on high production operations—especially boring. These tools are ideal for using the harder and more crater-resistant grades of Kennametal. The smaller inserts help reduce tooling costs.

All advantages of the Kendex principle are provided by the new line of Kendex Roller Turner Tools. These tools provide constant center height, accurate radius control, ease of tool changing, uniform chip control, higher production and lower cost per cutting edge. Solid Kennametal seat is standard . . . chipbreaker optional.

Why not investigate how you may use Kendex Tooling to speed production . . . reduce tool costs. A Kennametal engineer will help you apply Kendex Tools to your operations. He works exclusively with Kennametal Tooling . . . applying and servicing it. Call your nearest Kennametal office or write now to KENNAMETAL INC., Latrobe, Pa.

*Trademarks C-5018

Kendex Boring Bars are available in two styles: (1) bar with 15° lead angle and square insert; (2) bar for turning to a square shoulder with a triangular insert.

½" square Kendex holders for small "throw-away" inserts are available in four styles with Kennametal seats and chipbreakers.

KENDEX ROLLER TURNERS

Kendex Roller Turner holders, with shank sizes for standard Warner & Swasey, Gisholt and Jones & Lamson tools.

INDUSTRY AND **KENNAMETAL**
. . . Partners in Progress

KENDEX TOOLING PAYS OFF . . . Over and Over

you get Superior Quality at Lowest Price in

GEARED HEAD LATHES

With Pre-loaded TIMKEN Bearings Spindle

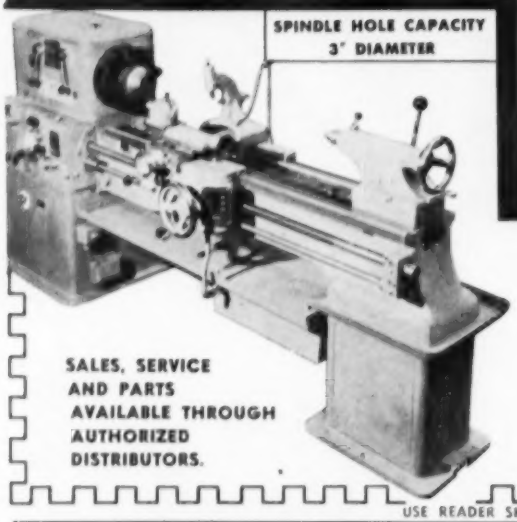
11" HYDRAULIC COPYING GEARED HEAD LATHE

for fast production of turned parts at low capital investment and labor costs.

- Copying unit is fitted to rear of lathe so that standard lathe operation is unrestricted. With a flick of a switch the copying unit is then engaged for the reproduction of the first piece.

Harrison

- 11" Standard and gap lathes also available.



SPINDLE HOLE CAPACITY 3" DIAMETER

SALES, SERVICE AND PARTS AVAILABLE THROUGH AUTHORIZED DISTRIBUTORS.

16" GEARED HEAD GAP LATHE

(25" swing in gap)

- Electrically operated SOLENOID brake easily adjusted for slow or quick stopping of spindle.
- An inching button mounted on the headstock permits a jogging action of spindle for easy setting of work pieces.

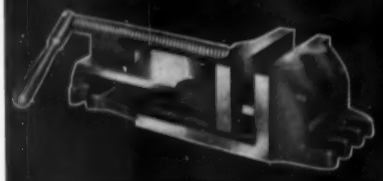
Write for catalogs and prices TODAY!

STANLEY SHEPPARD

U. S. Representatives • 30 Church St., New York 7, N. Y.

USE READER SERVICE CARD; INDICATE A-3-374-1

SPEED VISE



COSTS SO LITTLE

SAVES SO MUCH

Here's practical economy for your shop . . . a vise that costs so little . . . a vise that cuts down operating time . . . a vise that eliminates the need for expensive jigs and fixtures—Speed Vise does all this and more.

★ **YOU SAVE TIME** with Speed Vise because with a half-turn and a lift of the handle the jaw is free to slide to any desired opening . . . and you have positive locking with the same speed and ease.

★ **YOU SAVE MONEY** with Speed Vise because many interchangeable Speed Vise jigs and fixtures can be made for the price of one old style type box jig.

Write today for complete information and prices.

CARDINAL MACHINE COMPANY
1819 Dana Street, Glendale, California

USE READER SERVICE CARD; INDICATE A-3-374-2

Pat. No. 2466490 & Pat. Applied For

The Simmons System with Thread Triangles & Constant Chart $10.00 Postpaid in United States

Over 5000 Engineers, Tool Makers & Machinists Can't Be Wrong

SIMPLE! PRACTICAL!

Good for all standard threads.
Good for all non-standard threads.

THREAD TRIANGLES are hardened, precision-ground gauges in the form of 2 60-degree triangular bars. Each set comes with chart of sizes for all standard threads, thereby eliminating all arithmetic.

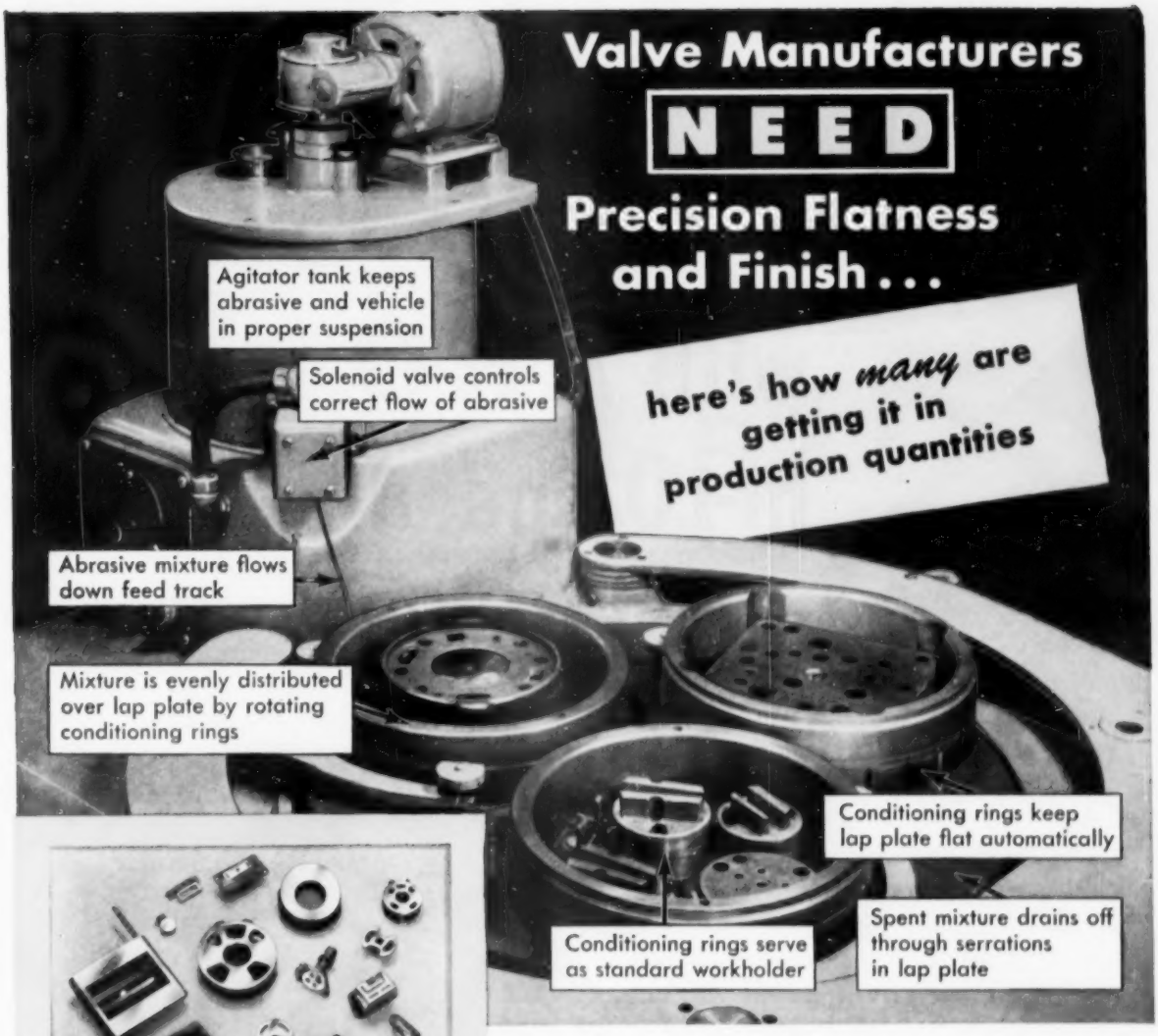
For special threads, a chart of triangle thread-constants is furnished, enabling ANY thread to be figured by adding 2 numbers only.

W. T. Simmons
Box 1303
Amarillo, Texas

Montgomery & Co., Inc.
No. 7 Tichenor Lane
Newark 5, N. J.

USE READER SERVICE CARD; INDICATE A-3-374-3

Valve Manufacturers NEED Precision Flatness and Finish...


Agitator tank keeps abrasive and vehicle in proper suspension
Solenoid valve controls correct flow of abrasive
here's how *many* are getting it in production quantities
Abrasive mixture flows down feed track
Mixture is evenly distributed over lap plate by rotating conditioning rings
Conditioning rings keep lap plate flat automatically
Conditioning rings serve as standard workholder
Spent mixture drains off through serrations in lap plate

A great many valve manufacturers are included in the more than 500 producers of industrial equipment using Lapmasters. All have found this machine to be the answer to obtaining precision flatness, finish and parallelity in production quantities. Types of valves include gate, slide, hydraulic, solenoid, rotary, diaphragm, etc. The high production accuracy of the Lapmaster (micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011″ when required) is being definitely achieved on all materials including cast iron, steel, stainless steel, magnesium, aluminum, brass, carbon, ceramics, plastics and sintered metals. It will pay you to investigate this modern precision, yet economical, method of machining.

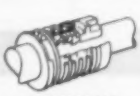
Get all the facts

Here are three booklets that will give you the facts on producing and measuring precision flatness and finish. Write for your copies today.

6469 Oakton Street, Morton Grove, Illinois • In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont., Canada

JOHN CRANE

MECHANICAL PACKINGS


SHAFT SEALS

TEFLON PRODUCTS

LAPPING MACHINES

THREAD COMPOUNDS

CRANE PACKING COMPANY

Save on AIR

with ARO HI-LO speed couplers

HI VOLUME of air . . . passes *all* the air you need . . . leakproof . . . positive lock . . . easy disconnect.

LO PRESSURE drop . . . most efficient coupler by actual test! Cuts operating costs for all air-powered devices.

Write for complete details on performance and sizes.

THE ARO EQUIPMENT CORPORATION
GENERAL OFFICES — BRYAN, OHIO
Plants at Bryan and Cleveland, Ohio
Aro of California, 3141 S. Grand Ave., Los Angeles 7, Calif. • Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ARO®

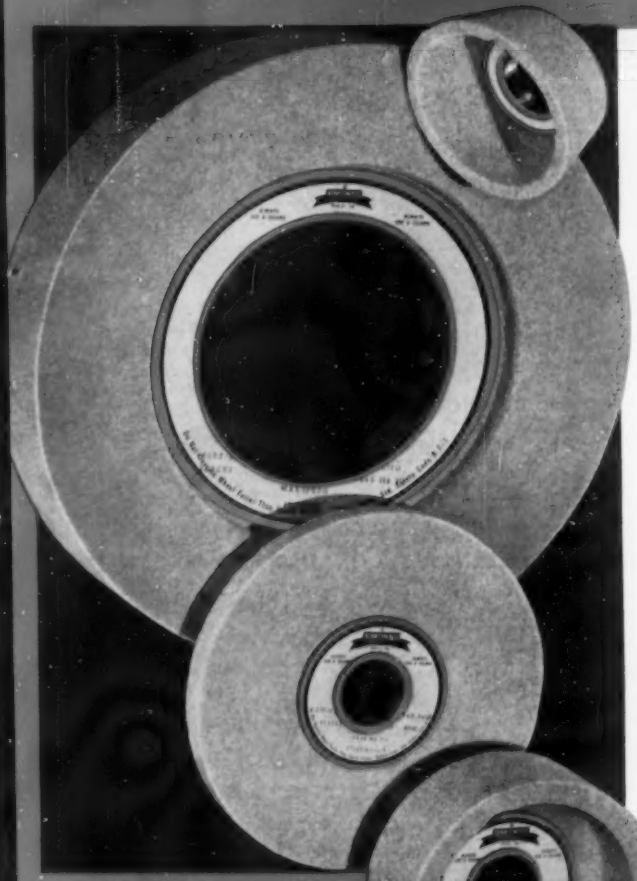
SPEED COUPLERS
Also AIR TOOLS . . . AIR HOISTS . . . LUBRICATING EQUIPMENT . . . AIR-CRAFT PRODUCTS . . . GREASE FITTINGS

New and Radically Different

SIMONDS SA Borolon®

TRADE MARK

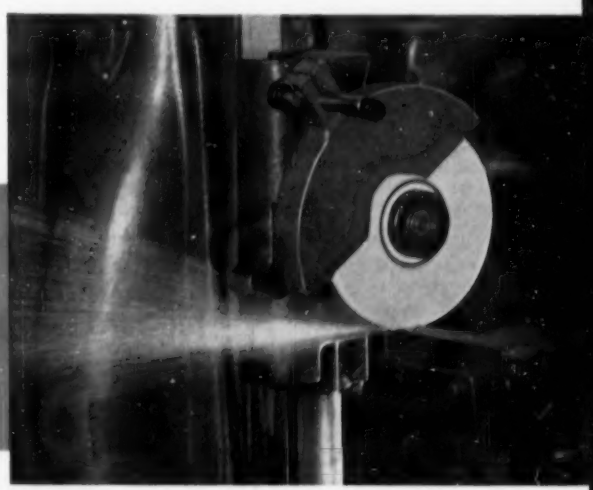
Grinding Wheels for Toolroom use



SA Borolon is a single crystal aluminum oxide abrasive possessing superior qualities over conventional white aluminum oxide abrasive. It is produced from a furnace charge consisting of a molten base with a soluble matrix which dissolves, leaving single, natural crystals of abrasive grain *without crushing.*

SA Borolon is tougher because it is free of the inner strains to which crushed abrasive is subjected. It penetrates deeper and cuts faster because each abrasive particle has more sharp, free-cutting edges. It cuts cooler because its resistance to dulling lessens frictional drag. Use these new wheels on your tool grinding jobs — and see the surprising difference in their grinding action. Write for illustrated Catalog Bulletin ESA-272.

Cooler cutting
Faster grinding
Longer life
Better finish



SIMONDS ABRASIVE CO.

SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA, CHICAGO, DETROIT, LOS ANGELES, SAN FRANCISCO, PORTLAND, ORE.

Over sixty thousand square feet of ultra-modern plant, completely equipped with the latest precision machinery, checking equipment and gages.

Forty engineers, versed in the instrumentation, production, automation and tooling fields.

Three hundred technicians, assemblers, machine operators and tool makers.

The engineering and/or manufacturing of components, sub-assemblies and complete assemblies from prototype to production are our specialty. In addition to this, our tool division is thoroughly versed in handling your tool and automation problems.

PIONEER TOOL & ENGINEERING CO.

7401 West Lawrence Avenue, Chicago 31, Illinois

BRIDGEPORT BRASS
COPPER ALLOY BULLETIN

Bridgeport Reporting New Developments in Copper-Brass Alloys and Metalworking Methods

Two Easily Machined Bridgeport Alloys That Offer Outstanding Advantages

by M. A. BUELL
Chief Staff Metallurgist

When everyday requirements call for dependable, fast-cutting rod, consideration should be given to two outstanding free-cutting alloys:

Bridgeport Alloy No. 6, the standard free-cutting brass rod, has exceptionally free-machining qualities. Containing 61% copper, 3.4% lead and 35.6% zinc, it has a uniform composition and can be finished to extremely close tolerances.

Bridgeport Tellurium Copper Alloy No. 112 offers unusually good machinability — 90 as compared to 100 for free-cutting brass Alloy No. 6 — but it also has extremely high electrical and thermal conductivity ratings as well as unusually high resistance to corrosion.

Tellurium Copper No. 112 is ideal for all types of electrical parts, welding torch and soldering iron tips, as well as any other heat- and electrical-conducting parts requiring considerable machining.

Comparative ratings of each alloy are given below.

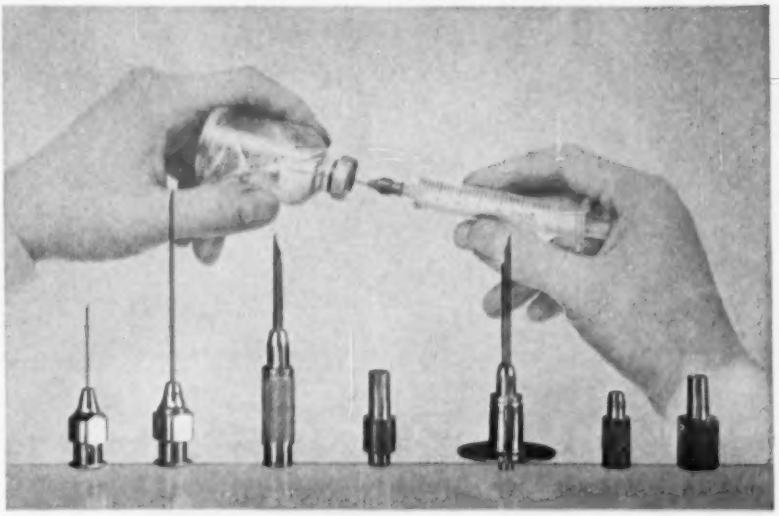
	Free-Machining Brass No. 6	Tellurium Copper No. 112
Thermal Conductivity*	67	204
Electrical Conductivity**	26	90
Machinability Rating	100	90
Cold-Working	Poor	Good
Hot-Working	Fair	Good
Hot-Working Range °F	1300-1450	1400-1600

*Btu/sq ft/ft/hr/°F @ 68° F
**% IACS @ 68° F Soft

Quick Way To Solve Your Metals Problems

Brass, copper and bronze alloys are all available in a widely varying range and combination of characteristics. Some are free-cutting, some have unusual ductility, others intrinsic hardness and still others high tensile strength. For best results, however, the metal should be matched to the job, both from the standpoint of machining as well as eventual product use. An easy way to get the answer to these questions is to talk over your metals selection problems with your Bridgeport salesman. Backed by Bridgeport's Technical Service, he can give you the finest possible help in solving your metals problem.

Free-Cutting Bridgeport Brass Plays Vital Role In Manufacture Of High-Precision Hypodermic Needles



Roehr Products Company, Inc., Waterbury, Connecticut, and Deland, Florida, manufactures over 1000 different types of hypodermic needles for every kind of medical and veterinary use. Each needle is designed and manufactured to high precision standards and to meet exacting tolerances on inside and outside diameters, finish and concentricity.

Hub Requirements

The hubs — an extremely important part of the needle from the point of view of exact fit — are made of Bridgeport Free-Machining Brass Rod, Alloy No. 6. Hub needle holes range from .018" to .085". Hubs are secured to the needles in a single press operation. In securing the needles to the hub it is imperative to avoid exerting excessive pressure — otherwise the needle walls would be pressed together and the needle would be constricted and useless. At the same time, the closure of the hub around the needle must be perfectly air- and liquid-tight. Each finished needle is tested under 45 pounds of pressure between the needle and the syringe.

Free-Machining Brass Is Versatile

The adaptability of Alloy No. 6 to the precise requirements of hypodermic needle manufacture is but another of the increasing number of jobs that this all-around alloy does so well. Its outstanding corrosion resistance is especially important in medical and pharmaceutical use. Its affinity for plating is another quality that governs its use in these instruments.

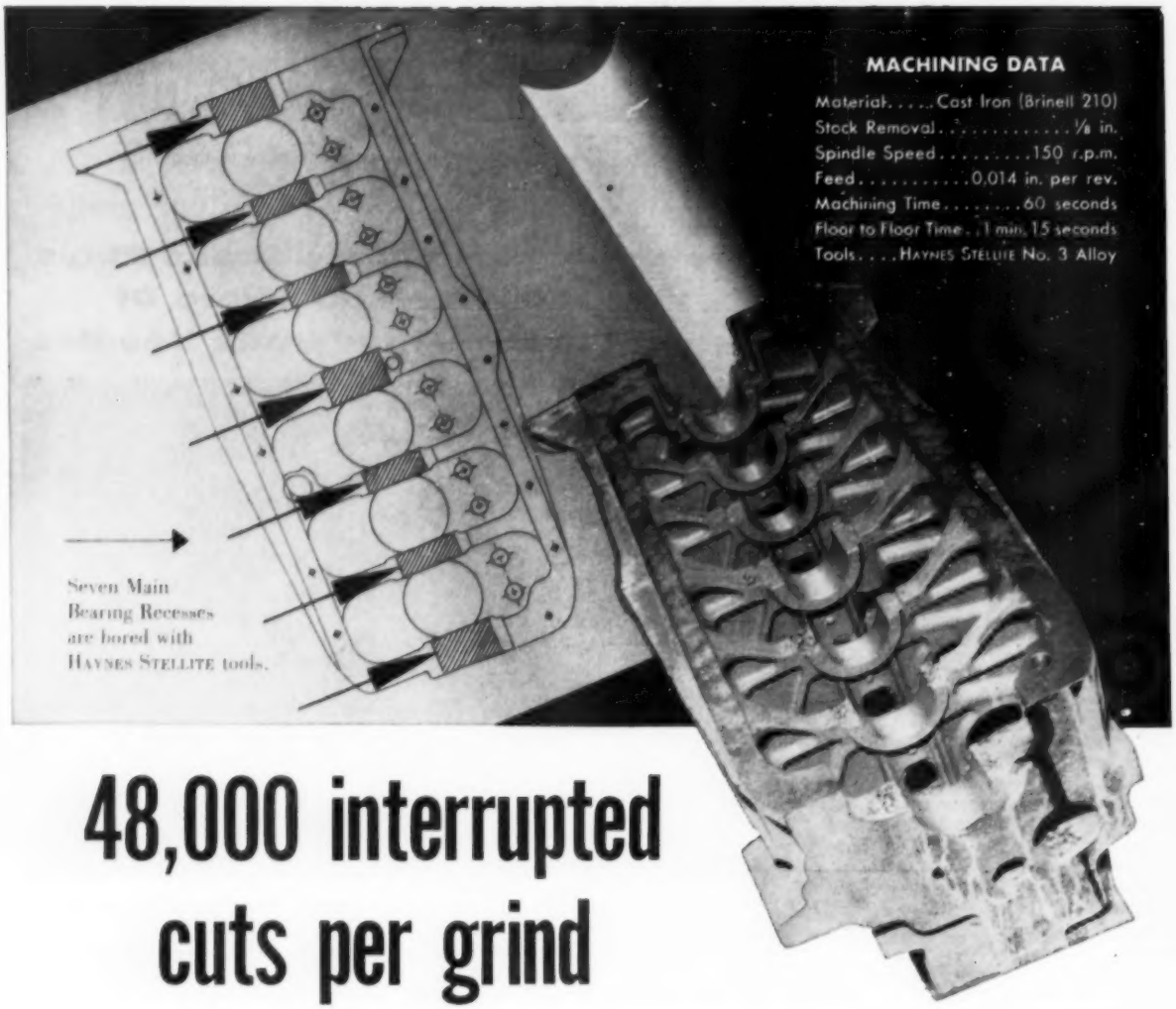
Wide Number of Uses

Many millions of needles are manufactured annually by Roehr—each must be flawless. Vaccine programs, blood banks, hospitals, doctors, veterinarians, research organizations, pharmaceutical houses — all must be sure that the needles they use are perfect in every respect.

Worth Investigating

Perhaps your present or future manufacturing or fabricating needs are not so exacting as Roehr's — perhaps they are more so. In either case, it will pay you to look into the impressive possibilities of Bridgeport Free-Machining Brass. Your Bridgeport salesman, with Bridgeport Technical Service behind him, will be glad to help. Call him.

BRIDGEPORT BRASS
Bridgeport Brass Company, Bridgeport 2, Connecticut, Offices in Principal Cities
In Canada: Noranda Copper and Brass Limited, Montreal


MACHINING DATA
Material.....Cast Iron (Brinell 210)
Stock Removal.....⅛ in.
Spindle Speed.....150 r.p.m.
Feed.....0.014 in. per rev.
Machining Time.....60 seconds
Floor to Floor Time..1 min. 15 seconds
Tools....HAYNES STELLITE No. 3 Alloy
Seven Main Bearing Recesses are bored with HAYNES STELLITE tools.

48,000 interrupted cuts per grind

HAYNES STELLITE tools machine the main bearing recesses in 320 cast iron engine blocks between grinds. Each of 14 tools used in the set-up makes 150 interrupted cuts in each block . . . a total of 48,000 interrupted cuts per grind. The tools remain in operation for a full eight-hour shift, without chipping or spalling. Other tools tested on this job chipped under the constant hammering of the intermittent cuts, and had to be replaced in less than an hour.

Standard tool bits ⅜ in. square and 2 in. long, made of HAYNES STELLITE alloy No. 3, are used for this operation. Only 0.015 in. of metal has to be removed when the tools are sharpened, and the tools can be reground about 30 times. Then, when they are too short to be used for boring the main bearings, they are used to machine the smaller cam bearing recesses. In this second operation the same tools can be reground about 50 times more!

There are four grades of HAYNES STELLITE metal-cutting tools varying in hardness, compressive strength, and impact resistance. For a complete description of properties, sizes, and recommended operating data, write for the free booklet, "HAYNES STELLITE Metal-Cutting Tools."

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

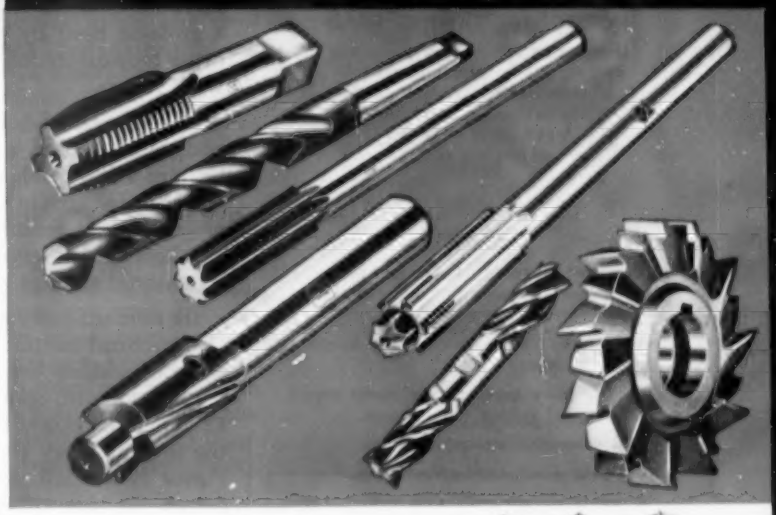
General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation

Complete line stocked by
the Standard Tool Distributor in your area



Call the "STANDARD" Man . . .
to advise the most economical operating procedure, based on knowledge and long experience.

He will help you select the best type of tap for your job from their *Complete Family* of metal cutting tools.

Quality Tools Since 1881

STANDARD TOOL CO.

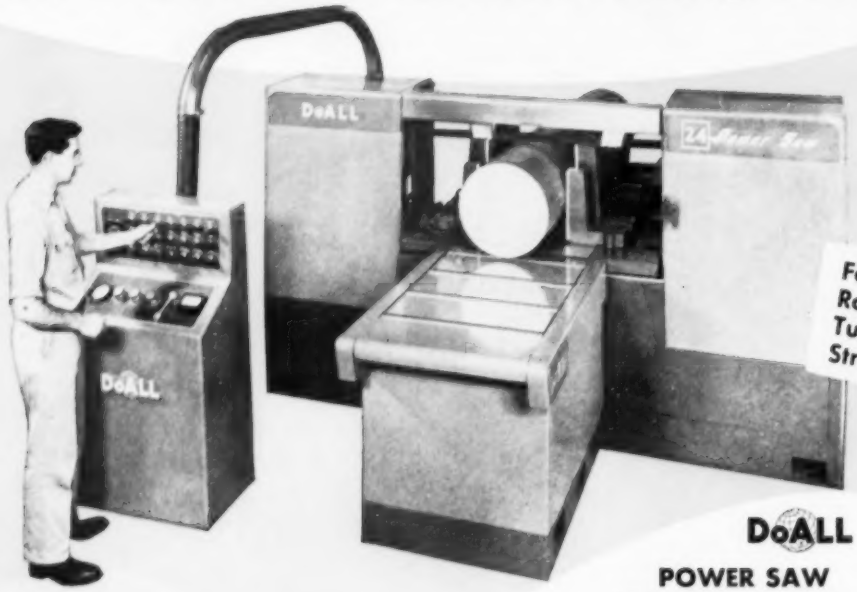
3950 CHESTER AVENUE CLEVELAND 14, OHIO

STANDARD TOOL CO.

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

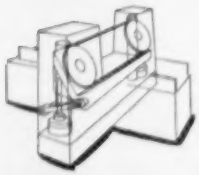
THE STANDARD LINE: *Twist Drills - Reamers - Taps - Dies - Milling Cutters - End Mills - Hobs - Counterbores - Carbide Tools - Gages*

Heavy Cut-off Work
Now Done with Band Sawing Economy



Forge Blocks
Rounds · Bars
Tubing · Pipe
Structurals

DoALL
POWER SAW
24″ x 24″ Capacity
HEAVY DUTY Horizontal CUT-OFF SAW



HORIZONTAL SAWING HEAD
Unique design insures ample power and rigidity for new rugged beam 2″ wide Demon HSS Saw Band. You get heavy cuts at high speed, long band life at low tool cost.

New Design packs power, rigidity and speed for the big cut-off jobs.

Here's a machine that was designed *from the ground up* to meet a growing need by steel mills and warehouses, shipyards and other fabricators for high speed, dead accurate cut-off of heavy work pieces.

The new DoALL Power Saw Model 24 packs power, rigidity and speed behind a new rugged, continuous cutting 2″ wide Demon HSS band. It will cut heavy bars, pipe, billets and structural shapes in a fraction of the time *at a fraction of the cost* of any cut-off machine of comparable capacity. And the narrow-kerf cut will give you a bonus of many more cuts per piece in material savings alone!

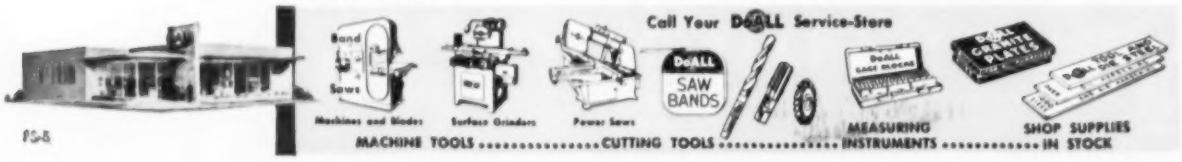
Its revolutionary horizontal design results in a combination of structural simplicity, speed and accuracy of cut with new ease of handling heavy work. Variable speed, fluid drive, complete automatic operation, automatic indexing of blanks up to 12′ long, and power positioned hydraulic vises are just a few of the revolutionary time and money saving features of this new Power Saw. Call your local DoALL Sales-Service Store for details on this outstanding investment today or write: The DoALL Company, Des Plaines, Ill.

FEATURES

- *Finger tip control* for instant response to change in speed or direction. (Manual control also available.)
- *Powered rollers* position the heaviest work pieces
- *Fluid drive speed control* meets broad range of cutting requirements.
- *Automatic indexing table*
- *Power positioned hydraulic vises*
- *Automatic self-drain chip removal*
- *Positive feed coolant system*

See DoALL — Booth 160
Western Metal Congress
Los Angeles—March 25 - 29

For Lowest Cost . . . do it on the DoALL!



FOUR WAYS TO IMPROVE YOUR GAGING PROGRAM

Starrett HIGH PRECISION LOW FRICTION Dial Indicators

1 CUT MAINTENANCE

With fewer parts and interchangeable gear assemblies in No. 25, No. 655 and No. 656 sizes, Starrett Dial Indicators cut maintenance costs. You keep more indicators in service longer with fewer spare parts to stock. The entire gear assembly can be removed as a unit for convenience in servicing.

2 IMPROVE ACCURACY

Simplified design with rugged, rigid construction means Starrett Dial Indicators are less subject to friction and wear. Replaceable low friction jeweled or inserted bronze bearings align accurately to eliminate end play. Rustproof stainless steel gears and tempered pinions, stainless and tempered racks and spindles and heavier bridge and case, all make for lasting accuracy.

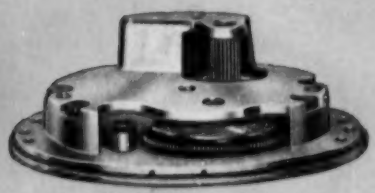
3 INCREASE EFFICIENCY

New easy-reading dials, satin chrome exterior finish and contrasting black bezels help operators read faster and more accurately with less eye fatigue. Count hands on long range models read directly in decimals . . . no calculations.

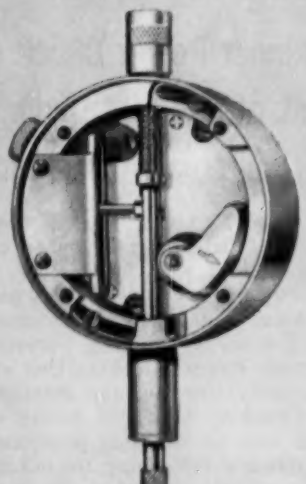
4 IMPROVE PERFORMANCE

Direct acting springs completely around the spindle or rack eliminate cocking and side friction. Action is smoother, more accurate, with less contact pressure. And with the new Nonshock mechanism to stop shock *before* it reaches the gear train, Starrett indicators stand up longer even on brutal gaging applications.

Front view showing easy-reading dial with contrasting black bezel



Interchangeable gear mechanism features simplified unit construction



View with back removed showing inside mechanism

SEND THE COUPON *for catalog describing the complete line of Starrett High Precision-Low Friction Dial Indicators.*

Buy through your INDUSTRIAL DISTRIBUTOR — Prompt delivery · Dependable service · Quality products

Starrett

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS · STEEL TAPES · PRECISION GROUND FLAT STOCK
HACKSAWS · HOLE SAWS · BAND SAWS · BAND KNIVES

The L. S. STARRETT COMPANY, Dept. E
Athol, Massachusetts

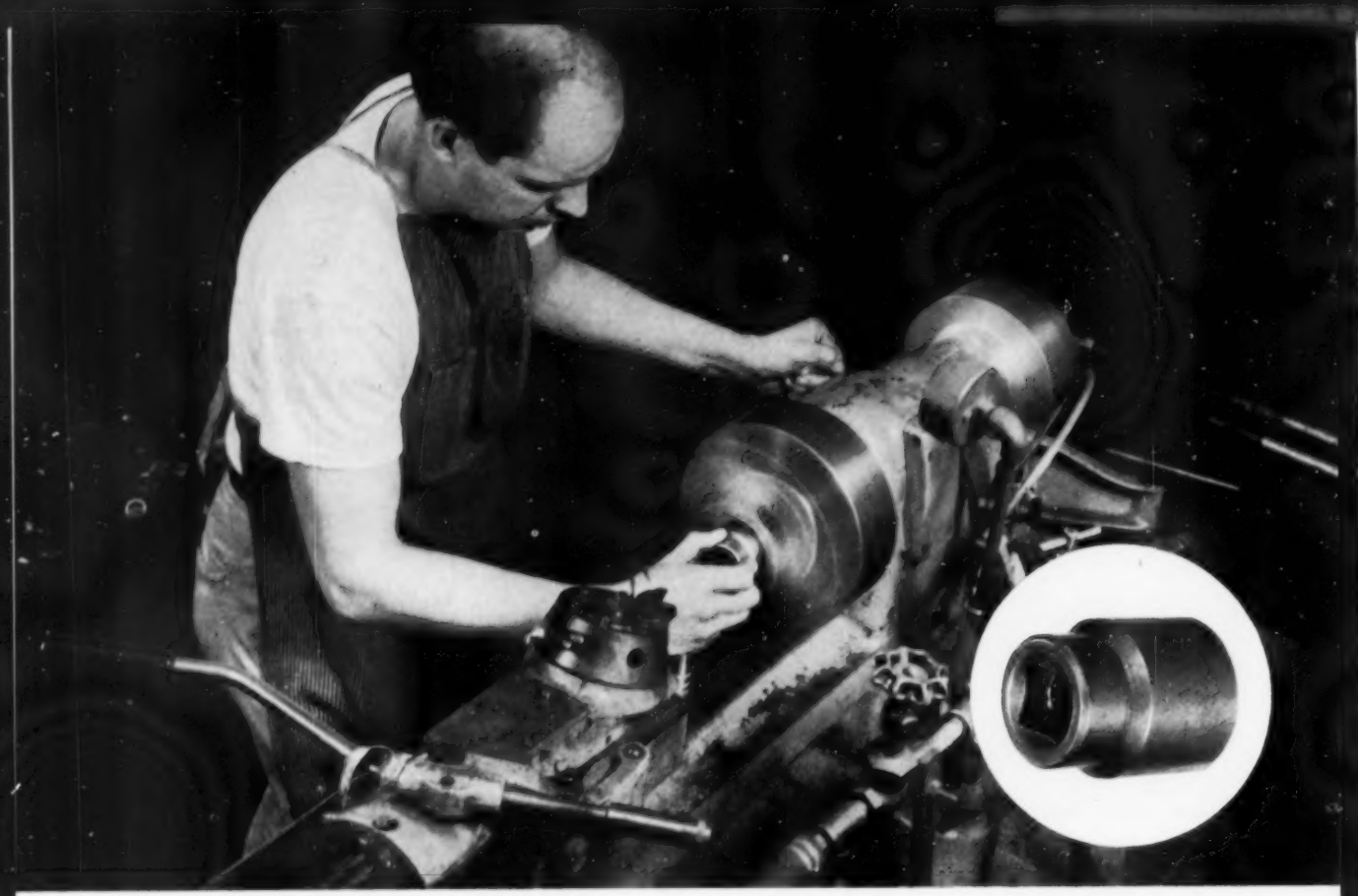
Please send information on Starrett *High Precision-Low Friction* Dial Indicators.

Name . . . . . Title . . . . .

Company . . . . . .

Street and Number . . . . . .

City . . . . . Zone . . . State . . . . .



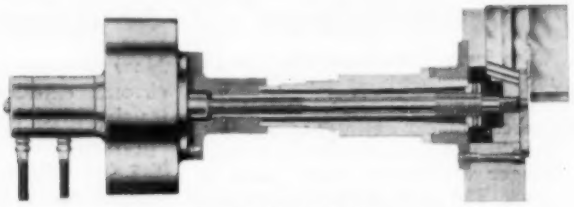
Skinner Power Chuck eliminates cost of special grinding operation . . . increases production, too

In this plant, a Skinner "junior" Power Chucking Unit replaces the standard collet chuck of this small Hardinge turret lathe.

When the collet was used, work pieces had to be held to tolerances of .004" for proper chucking, which made necessary a special grinding operation. Installation of this Skinner Power Chucking Unit eliminated this special operation, since the jaw movement of the Skinner Power Chucking Unit will permit wide variations in diameter with no chucking problems whatever.

In addition to this saving, the instantaneous automatic gripping and releasing of the work pieces has notably increased production.

Skinner Power Chucks will convert your present lathes — small and large — into high-production machines, and will greatly reduce your most important cost factor — overall machining time. Write Department 183 and ask for Catalog 68P, with complete specifications, applications, and installation instructions.

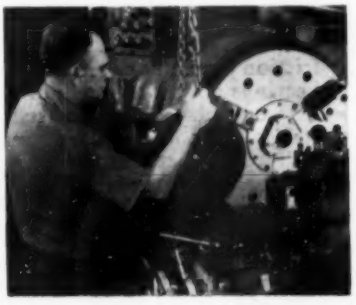


Simple, Dependable, Safe Operation

The tight gripping jaws are closed or opened instantly by an actuating wedge operated by a double-acting air cylinder. This simple mechanism is positive and trouble-free — there are only four moving parts in the chuck head. If air pressure suddenly fails, the jaws do not release the work piece, but continue to hold it tight until air pressure is restored.

Reduces operator fatigue, increases efficiency

Especially on your larger lathes, where hand wrenching is a time-consuming, fatiguing process, Skinner Power Chucks assure more efficient operation — since air pressure does the hard work. Operator's hands are free to guide and position work pieces accurately.



SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY

Established 1887

NEW BRITAIN, CONNECTICUT

OK multi-operation tools—
more beef in the body

One man,
one machine,
one pass,
now does the work of six
A winning combination to reduce costs . . .
OK modern milling cutters
mounted on modern milling machines

OK

THE OK TOOL COMPANY, INC.
300 Elm Street
Milford, New Hampshire

FREE: FIFTY PAGES OF NEW ENGINEERING PRINTS SHOWING ADVANCE IDEAS IN MULTIDIAM. ONE PASS TOOLS FOR BORING, MILLING AND REAMING OPERATIONS.

"A BETTER LIFE THROUGH CREATIVE MANUFACTURING"

25th ANNIVERSARY 1932 1957

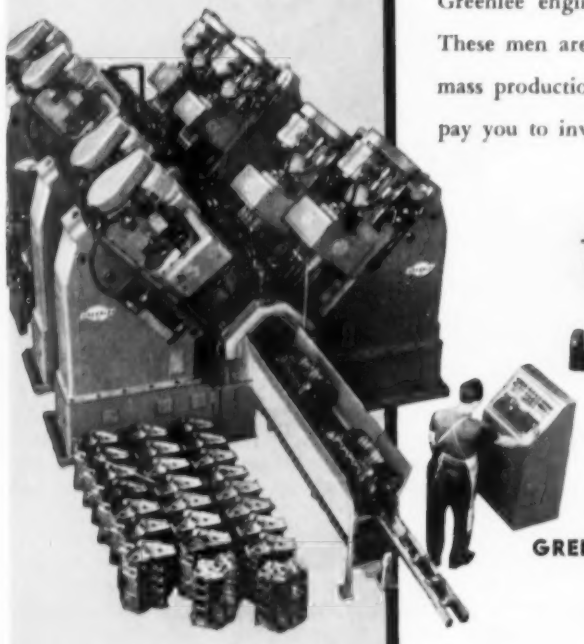
A BETTER LIFE THROUGH CREATIVE MANUFACTURING

Greenlee salutes the American Society of Tool Engineers on their 25th Anniversary.

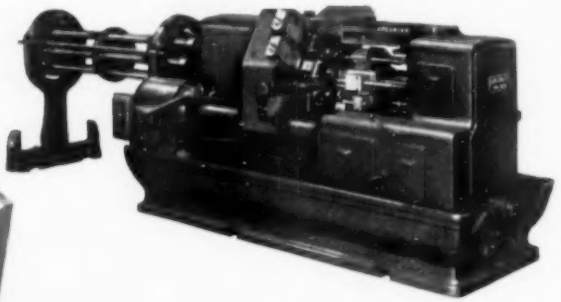
PRODUCTION MACHINERY

GREENLEE

1866 1957



Creative manufacturing begins with creative planning. Baffling problems of production have a way of disappearing when you invite Greenlee engineers to participate in your preliminary planning. These men are well acquainted with the mechanics and economics of mass production. Their thinking is sound . . . creative. It will pay you to investigate. Write or phone for a consultation today.



GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

1983 MASON AVE.
ROCKFORD, ILL.

KNOW YOUR CARBIDES . . . No. 2 IN A SERIES

Vacuum Sintering

HYDROGEN SINTERING

(Conventional Method)

Oxidation is the primary enemy of carbide quality. The conventional method of sintering calls for the blank to be heated in a hydrogen atmosphere in an attempt to "scavenge" oxygen from the blanks. Unfortunately, this process results in the formation of hydrogen compounds which also reduce carbide quality. Also, it is difficult to maintain hydrogen furnaces to the critical temperature requirements.

Vacuum sintering has supplied the answer to the problem. The blanks are electronically heated in a near-perfect vacuum. No oxygen or hydrogen is present. No contamination can occur.

HOW Vacuum Sintering GUARDS CARBIDE QUALITY

Industry has been greatly impressed with the superior performance of the new "premium grades" of tungsten carbide. Most companies in the field now sell one or two. These premium grades must be processed by the "vacuum sintering" method in order to maintain the higher quality standards.

In years to come, all carbide plants will use the vacuum sintering process exclusively, as obsolete hydrogen equipment wears out and is gradually replaced. But, today, if you want premium tool performance you must insist on vacuum sintered carbide.

Valenite vacuum sinters all 14 grades, not just one or two. And remember this . . . Valenite supplies these 14, premium quality, vacuum-sintered grades at the same or lower prices now charged for the regular hydrogen sintered carbides!

Vacuum Sintering is only one of Valenite's advanced techniques.

VALENITE® METALS

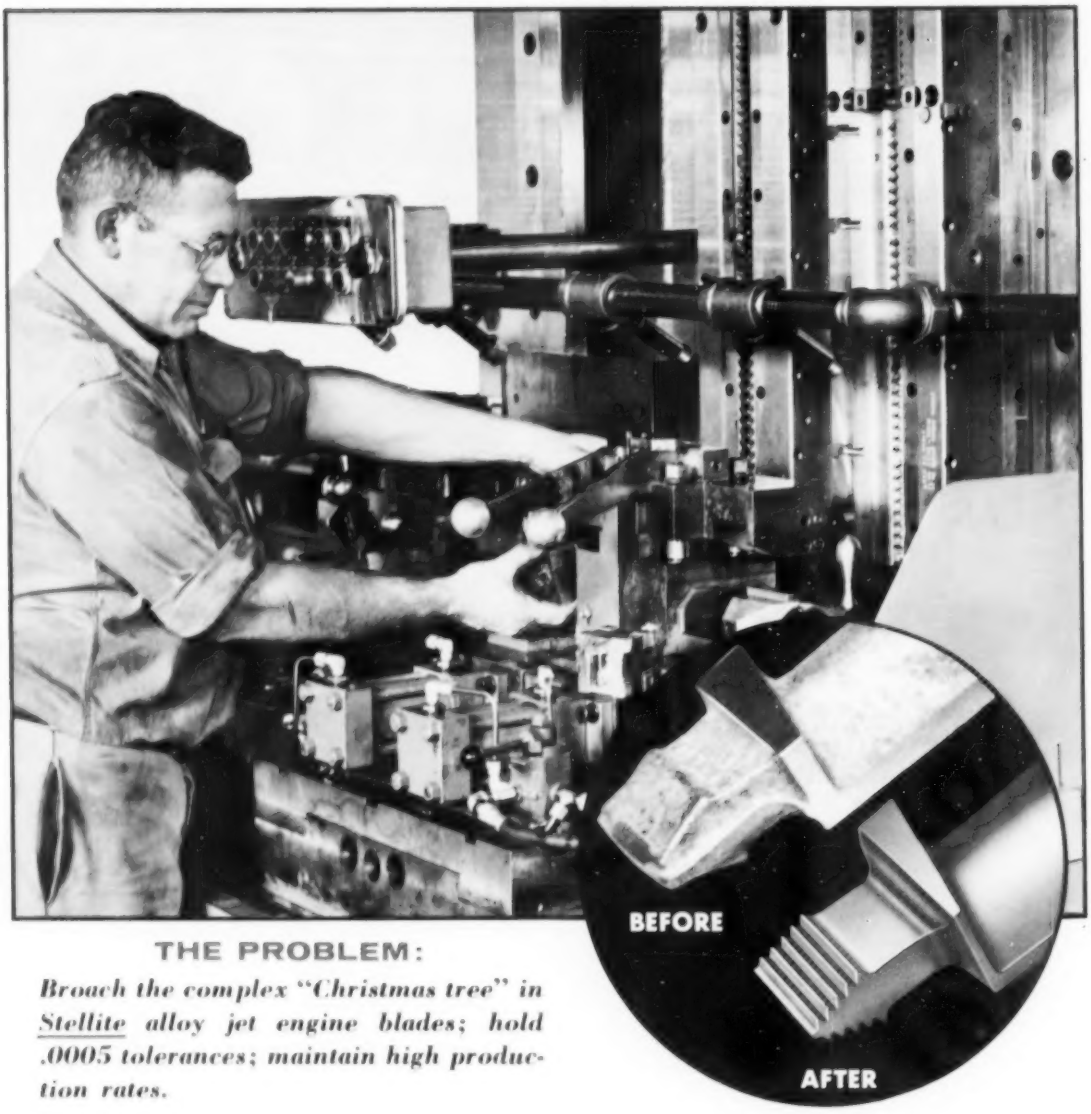
DIVISION OF THE VALERON CORPORATION

BOX 205 • ROYAL OAK, MICHIGAN

FREE . . . your copy of the Valenite Handy Reference. Packed with useful tables and formulas. The most useful book of its kind. Write for your copy (on your company letterhead, please.)

To see what vacuum sintered carbide can do — turn page

Solved – a tough broaching problem!



THE PROBLEM:

Broach the complex "Christmas tree" in Stellite alloy jet engine blades; hold .0005 tolerances; maintain high production rates.

Conventional broaching tools failed to do the job and were worn out after only a few passes through this tough material. But, by using rugged equipment, an ingenious tooling setup, and Valenite vacuum-sintered carbide on the broaches, Detroit Broach and Machine Company, of Rochester, Michigan, solved the problems of this "impossible" job.

Say Detroit Broach engineers: "Broaches tipped with Valenite carbide hold up amazingly well on the jet blade job. Also, the preformed carbide blanks arrive at our plant exceptionally close to finished dimensions, thus our finishing work is cut to a minimum. Our customer is pleased with the results we were able to give him on this job; we are pleased with Valenite quality and service."

Maybe you have a tough machining job in your plant where VALENITE carbide can cure production headaches. And remember . . . you get faster delivery on money-saving preformed carbide parts from Valenite!

FREE . . . your copy of the Valenite Handy Reference. Packed with useful tables and formulas. The most useful book of its kind. Write for your copy (on your company letterhead, please.)

VALENITE®
METALS

Division of the Valeron Corporation
Box 205 • Royal Oak, Michigan

The Oakite CrysCoat Cleaning-Phosphating Process for preparing metals for painting

GENERAL ELECTRIC water coolers combine modern styling with advanced engineering. And World-Famous GENERAL ELECTRIC dependability assures long, useful life and trouble-free operation. Beneath the beautiful gray-hammered finish of these compact units is a fine protective phosphate coating of CrysCoat to make the finish look better . . . last longer.

There's an Oakite CrysCoat Process to suit your particular set-up:—

1. Zinc phosphating in spray washer
2. Zinc phosphating in tank
3. Iron phosphating in spray washer
4. Iron phosphating in tank

Each CrysCoat Process gives you a fine phosphate foundation for long-lasting paint adhesion.

Each CrysCoat Process protects against corrosion under the paint.

Each CrysCoat Process is easy to control.

Each CrysCoat Process is solidly backed by nationwide Oakite Service that unconditionally guarantees satisfaction.

Illustrated literature describing the Oakite CrysCoat Cleaning-Phosphating Process gladly mailed on letterhead request.
Oakite Products, Inc., 19 Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

CrysCoated Products Look Better . . . Last Longer!

Technical Service Representatives Located in Principal Cities of United States and Canada

cost-saving tips on SPECIAL SCREWS

1. **USE STANDARD SCREWS IF POSSIBLE.** Save money by designing the *job* to the *screw*. Use specials only where absolutely required.
2. **DETERMINE YOUR APPLICATION REQUIREMENTS.** Over-design and under-design both waste money.
3. **CONSULT A FASTENING SPECIALIST.** Do this before finalizing your design. His suggestions may lead to a simpler, lower-cost answer.
4. **DON'T MAKE SPECIALS YOURSELF.** It actually costs *less* to use a dependable, experienced screw manufacturer. No hidden costs, no tie-up of your valuable men and machines.
5. **BUY FROM YOUR INDUSTRIAL DISTRIBUTOR.** He can expedite delivery, provide valuable local services and is convenient for re-ordering.

■ Your most dependable source for special screws is *Mac-it*. Production flexibility assures maximum quality at lowest cost; engineering assistance is always available; personal attention to each order by craftsmen means exact compliance with your blueprint specifications.

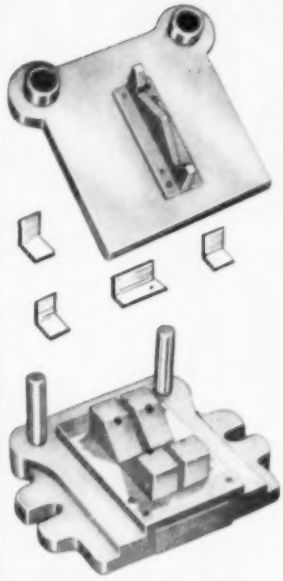
For finest service and fastest delivery on orders for one or 100,000 "specials", contact your local *Mac-it* distributor or: Mac-it Screw Division, Strong, Carlisle & Hammond, 1392 West 3rd Street, Cleveland 13, Ohio.

MAC-IT hex socket alloy cap & set **SCREWS**

USE READER SERVICE CARD; INDICATE A-3-390-1

Punches and Dies

Angle Iron Cut Off Die



No. 18, cut off die, for 2"x2"x¼" and lighter angles. Mounted in leader pin die set. Fits 'most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Also adaptors and die shoes to convert your press. Each precision-made.

25th ANNIVERSARY 1937 1912

What are your punch and die needs? Consult us about your problems. Prompt service on "specials" made to your order.

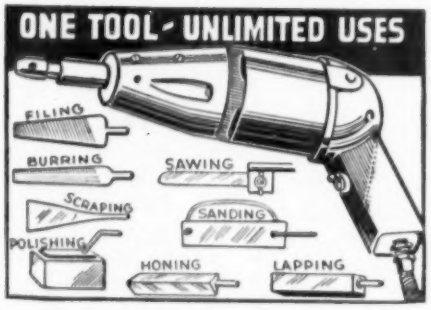
Send for free illustrated catalog No. 184 AC. Net prices shown.

WARD Machinery Co. 564 West Washington **Chicago 6**

USE READER SERVICE CARD; INDICATE A-3-390-2

B-R-E-A-K....
Hand Finishing Bottlenecks

with PORTABLE - ELECTRIC RECIPROCATING TOOLS



These handy tools will cut out many tedious hand filing and finishing operations—Increase Production—Produce Uniform Work.

Light in weight—Delivers ⅛" or ⅜" fixed stroke at 1000 strokes per minute—Operates on 110 volts AC or DC.

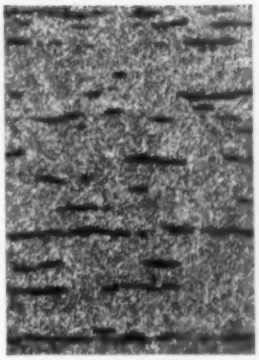
ACME TOOL COMPANY

75 W. Broadway New York 7, N. Y.

USE READER SERVICE CARD; INDICATE A-3-390-3

How to make gages and dies that last 3 times longer and make them faster

CHANCES are you can make your gages or dies last three times longer by making them from Graph-Mo® tool steel. Users report that Graph-Mo tool steel outwears other tool steels on an average of 3 to 1. A combination of free graphite and diamond-hard carbides in its structure makes this possible.



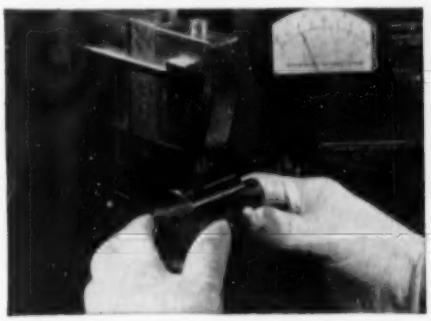
100 times magnification of Graph-Mo showing free-graphite and diamond-hard carbides.

And you can make gages and dies *faster,* too, with Graph-Mo. Constant Pressure Machinability tests show that Graph-Mo steel machines 30% faster than other tool steels.

The gages and dies you make from Graph-Mo steel will not only give you the important benefits of wearability and machinability, but also they'll stay accurate longer. Tests prove the stability of Graph-Mo steel. For example, a typical master plug gage made of Graph-Mo steel showed less than 10 millionths of an inch variation from its original dimensions after 12 years of use. It's the most stable gage steel ever made.

Because Graph-Mo steel has a minimum tendency to pick up, scuff or gall, it makes for a much better surface on your dies and gages. Graphite particles in Graph-Mo steel act as a "built-in" lubricant. Tests on the Amsler Wear Machine show Graph-Mo steel has twice the resistance to galling compared with ordinary tool steels.

So to get the most wearable, machinable and stable tool steel there is, get Graph-Mo. You can readily tell it by its "graphitic look"—the tiny, scattered parallel marks just barely visible on a piece of polished Graph-Mo. Insist on this "trade-mark" that's part of the steel



Graph-Mo steel plug gage tested for 12 years to prove stability.

itself the next time you buy gages, dies or tool steel. For more information, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

SOSSNER TAPS *are triple tempered*

Yes! Sossner taps are tempered, not just once, not just twice, but THREE TIMES. The result . . . a tougher, more reliable, longer lasting tap . . . less chipping . . . less breakage.

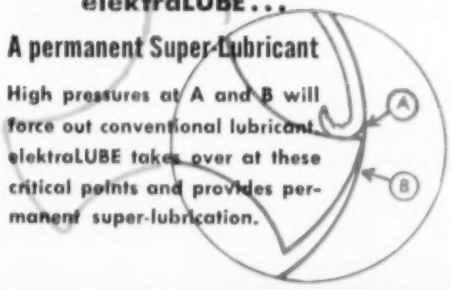
Triple Tempering, standard with Sossner, can make all the difference. Get FULL VALUE taps . . . Get SOSSNER.

OTHER SOSSNER EXCLUSIVES

elektraLUBE . . .

A permanent Super-Lubricant

High pressures at A and B will force out conventional lubricant. elektraLUBE takes over at these critical points and provides permanent super-lubrication.



SPIRAL TAPS . . .

The most complete line

Regular Style	#4 thru 5/16"
Hook Style	#3 thru 5/16"
Three Flute Style	1/4" and 1/2"
Double Scoop Style	*Special Application*

SOSSNER TAP & TOOL CORPORATION
29 BROADWAY, LYNBROOK, L.I., N.Y.

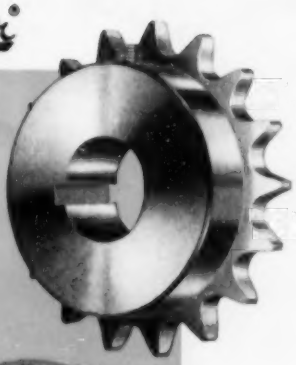
Inquiries from representatives and distributors are invited.

FACTORY WAREHOUSES IN NEW YORK AND LOS ANGELES • DEALER STOCKS IN OTHER CITIES

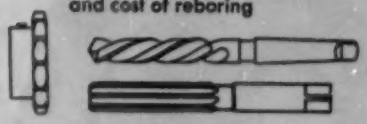
Here's how YOU SAVE with **BOSTON Gear**

BORED-TO-SIZE SPROCKETS

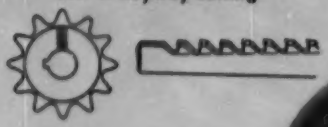
complete with keyway and set screw . . . ready to install



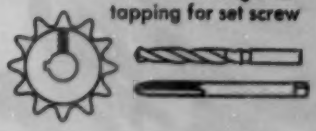
YOU SAVE time and cost of reboring



YOU SAVE time and cost of keyway cutting

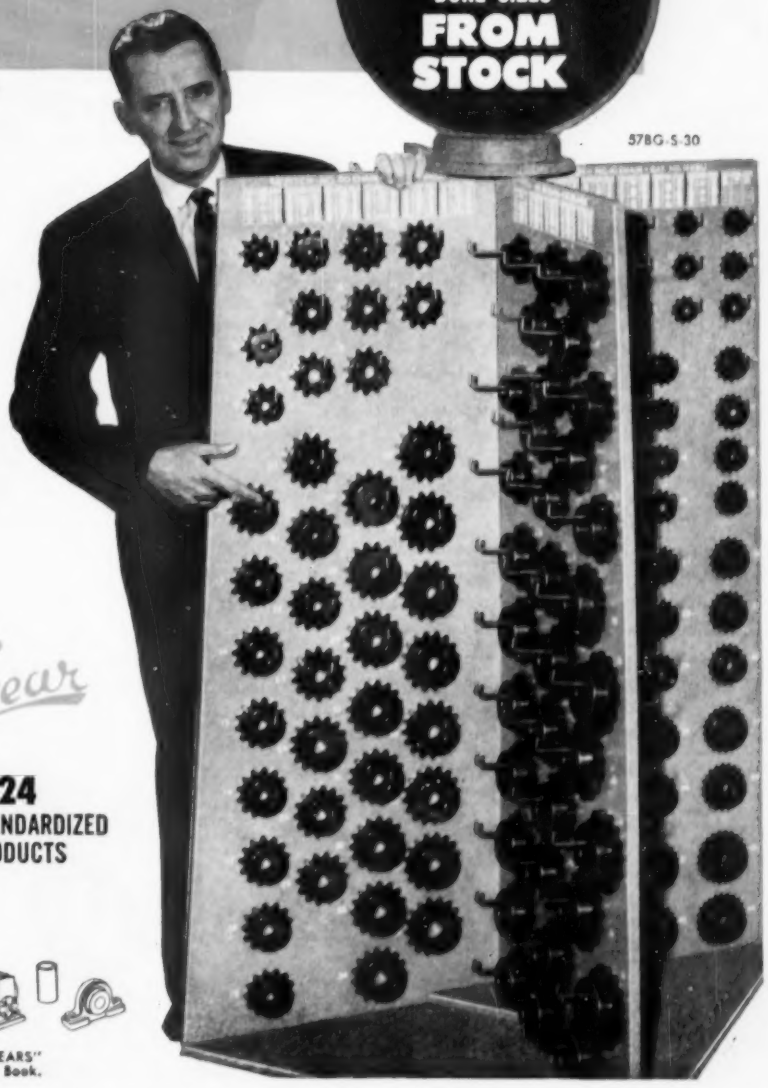


YOU SAVE time and cost of drilling and tapping for set screw



YOU SAVE delay and cost of downtime in emergencies

76 PINION SIZES WITH **321** BORE SIZES **FROM STOCK**



Your Boston Gear Distributor can deliver promptly any size and bore you need from the full selection of 321 different pinions on his BORED-TO-SIZE SPROCKET stock rack.

Why "do-it-yourself" . . . at double the cost? Select the sprocket you need FROM STOCK, and get Boston Gear precision, finish, and performance that assures longer service life for both sprocket and chain. See Catalog No. 56 for complete listings — and other Boston Gear Sprockets to meet any drive need. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

CALL YOUR BOSTON Gear DISTRIBUTOR

FOR DELIVERY OFF-THE-SHELF AT FACTORY PRICES

STOCK GEARS
SPROCKETS and CHAIN
SPEED REDUCERS
BEARINGS • COUPLINGS

7124 STANDARDIZED PRODUCTS

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book.

OSBORN BRUSHING METHODS worthy of your confidence

Worm turns for faster finish

REMOVING fine feather burrs and blending surface junctures on steel worms is an exacting operation. Hand methods are slow and costly . . . quality irregular.

Today, using Osborn Brushamatic® Methods, vastly improved results are achieved quickly and economically. The operator merely loads and removes the part from the machine. No special skill is required. Absolute uniformity, piece after piece, assures uninterrupted assembly, eliminates scrap loss.

Results that can be obtained by Osborn Power Brushing methods are virtually unlimited. Without obligation, an **O**sborn **B**rushing **A**nalyst will survey your manufacturing needs. Write *The Osborn Manufacturing Company, Dept. D-32, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushamatic 3A.

Send TODAY for the new 20-page Brushamatic Booklet.

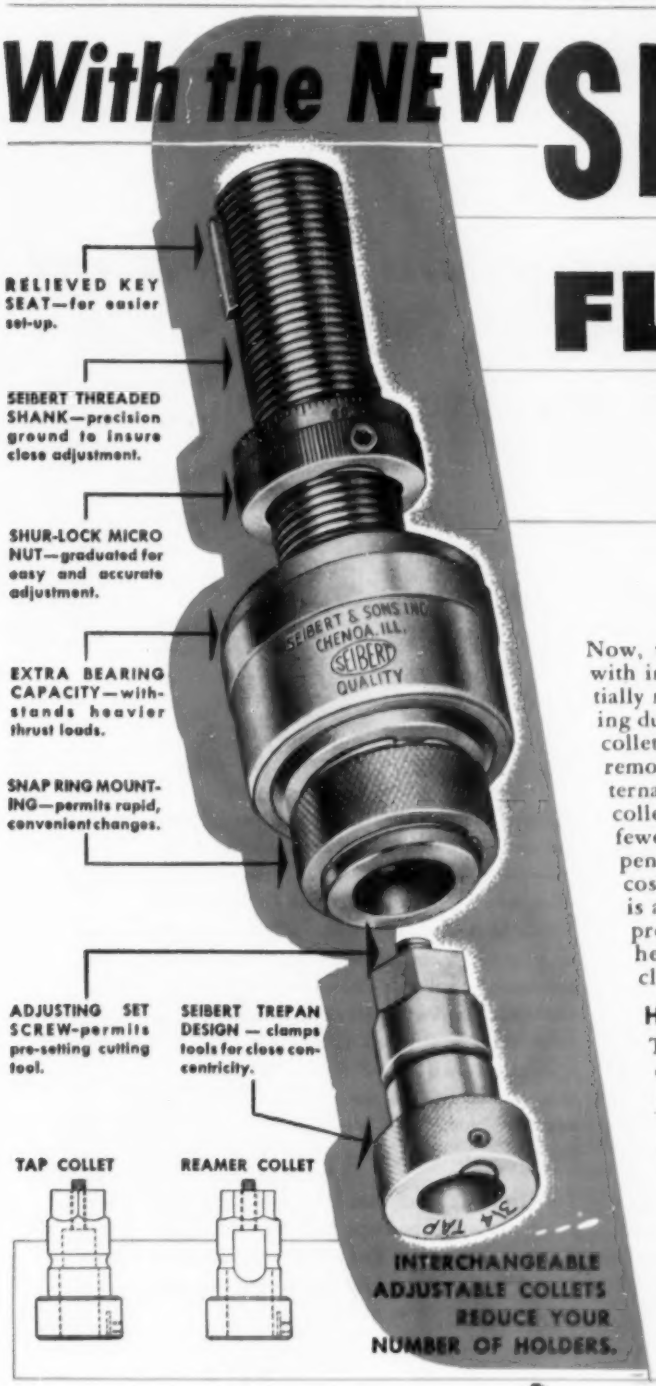
Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Convenience • Economy • Efficiency •

With the NEW SEIBERT FLOATING HOLDER

(Patent Applied For)


RELIEVED KEY SEAT—for easier set-up.
SEIBERT THREADED SHANK—precision ground to insure close adjustment.
SHUR-LOCK MICRO NUT—graduated for easy and accurate adjustment.
EXTRA BEARING CAPACITY—withstands heavier thrust loads.
SNAP RING MOUNTING—permits rapid, convenient changes.
ADJUSTING SET SCREW-permits pre-setting cutting tool.
SEIBERT TREPAN DESIGN — clamps tools for close concentricity.
TAP COLLET
REAMER COLLET
SEIBERT & SONS INC CHENOA, ILL. SEIBERT QUALITY
INTERCHANGEABLE ADJUSTABLE COLLETS REDUCE YOUR NUMBER OF HOLDERS.

Fast Change Pre-Setting Collets Reduce Number of Holders Needed

Now, with the new Seibert Floating Holder equipped with interchangeable auxiliary collets, you can substantially reduce costs on tapping and reaming jobs requiring duplicate pre-set tooling. As illustrated, the auxiliary collet is snap-ring mounted in holder for quick and easy removal. No wrenches or drifts are required. An internal adjusting set screw permits pre-setting tools in collet without removing holders. Thus you require fewer holders per job, and because collets are inexpensive you effect substantial savings in overall tool costs. Close concentricity is maintained because tool is accurately held in collet by trepan clamp which is precision machined to close limits. Elimination of hex nut clamping principle also provides extra clearance when tapping in counter bored holes.

Heavy Duty Holder Assures Long Service Life

The holders are heavy duty roller-type and are especially designed with extra bearing capacity to assure long service life. All shank types are available in a range of sizes including the adjustable adaptor shank illustrated. Send for full information today on these new cost cutting tools.

WRITE FOR COMPLETE DATA

Get the complete story on the new Seibert Floating Holder. Ask for illustrated specification sheet or have a Seibert Sales Engineer call at your plant to check over your tooling requirements.

Tension or Compression Tap Drivers
800 Series Spindle Extension
900 Series Spindle Extension
Sur-Lock Adjustable Adapters

SEIBERT

SEIBERT & SONS, Inc. 1003 E. 24th Street • CHENOA, ILLINOIS

QUALITY MULTIPLE DRILL SPINDLE AND PRODUCTION TOOLS

CARBORUNDUM® INTRODUCES:

Maximum Automation Potential

newest concept in Abrasive Technology

predicts metal removal savings with abrasive belts before capital investment

M-A-P is a *new* industrial forecast method. It is designed for automation-minded manufacturers whose production operations include heavy stock removal, finishing or semi-finishing of component parts. M-A-P predicts operating-cost savings and production increases resulting from the engineered application of the correct machine and abrasive belts—in advance of any investment in material or equipment.

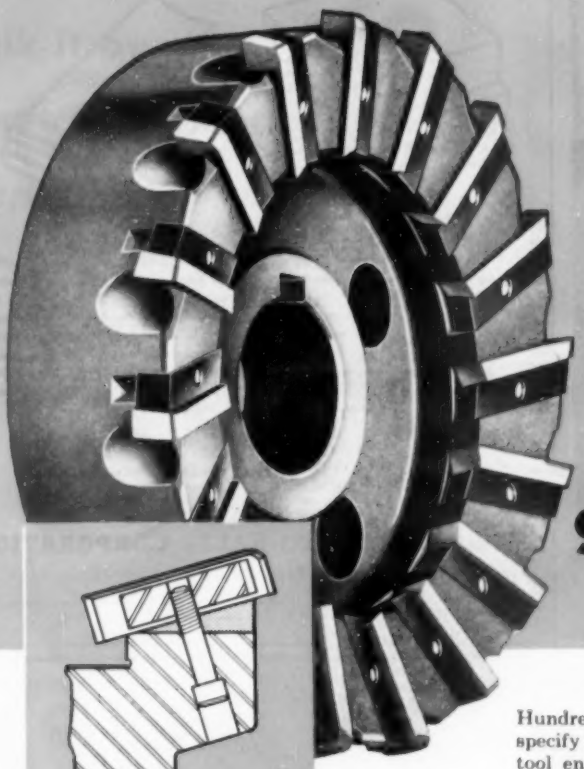
M-A-P is actually the application of science to metal removal—economic science and abrasive science combined to take the guesswork out of grinding. M-A-P formulas were developed by The Carborundum Company's Coated Abrasive Engineers from a study of all standards and factors entering into abrasive belt grinding operations. M-A-P is based on the accumulated knowledge of Carborundum's years of coated abrasive manufacturing experience and the abrasive machinery know-how of its Curtis Machine Division.

Maximum Automation Potential predictions are now available to you as a standard engineering service of The Carborundum Company's Coated Abrasives Division. To get an M-A-P study on one of your present or planned metal removal operations, you need only supply a few basic production facts. Carborundum engineers do the rest—M-A-P formulas are applied specifically to your operation—*an M-A-P Recommendation is then mailed back to you.* Now, with M-A-P you can *predict and compare* return on investment—without obligation.

For further information, write to The Carborundum Company, Dept. 310, M-A-P, Senior Coated Abrasives Engineer. Ask for the M-A-P Brochure which explains this new engineering service to industry in detail.

The **CARBORUNDUM** Company
COATED ABRASIVES DIVISION
Niagara Falls, New York

"10 YEARS ON THE JOB and our Super SOLID CARBIDE cutter's still going strong"



SUPER IBH CUTTER

For aluminum, steel, most other metals. All the features of our HBH Cutter except

- Blades are at 10° positive angle to radius
- Number of blades is diameter +2.

For efficiency, select the correct grade of carbide for the metal; grind to the proper angle. Your Super IBH Standard Cutter will do the rest!

Hundreds of tool men everywhere tell us willingly *why* they specify Super HPH and IBH Standard Milling Cutters. As a tool engineer, machinist or tool buyer you'll value these *reasons* why many shops have worked Super cutters for over ten years, always with economy and quality.

Here's why: For high speed machining of cast iron, malleable iron or brass, our HPH cutter has big *solid* carbide blades for maximum strength and elimination of braze strains. Blades are set radially, the number being the diameter x 2. You sharpen with a minimum removal of carbide—not the $\frac{1}{16}$" you lose with serrated-back blades—as Super blades can be moved a few thousandths or less at a sharpening. Then after scores of sharpenings, you use the carbide down to a stub because our wedge (with a filler-blade) gives you a locking area the complete length of the slot. The blade is solid as though part of the body itself since there are no back-up screws. If a wreck occurs—as it may in the best of shops—only the wedge is damaged or scrapped, not your cutter body. There are no threads in the body to strip as our wedges are tapped to take locking screws let in from the back.

The Super cutter body is #4130 Steel, heat treated for optimum strength. Drift pockets are machined under wedges for quick removal or adjustment. Mounting is versatile; it may be bolted on a #50 NMTB mount and it also has a keyway and ground boases for arbor mounting.

Why not write for our complete catalog of solid and carbide tipped tools and the name of our stocking distributor near you. Thousands of satisfied tool buyers *must* be right; we'd like to have you join them.

Super TOOL COMPANY

21650 HOOVER RD. • DETROIT 13, MICHIGAN

WAREHOUSES · CHICAGO · DETROIT · NEW YORK · LOS ANGELES ·

Subsidiary of Van Norman Ind., Inc.

Whether you are tooling for short or long-run parts

Hi-Den can roll back forming costs

Above: Hi-Den die which has been band-sawed to rough shape, being hand-finished with woodworking tools to required accuracy. Use of Hi-Den can reduce die fabrication and forming costs 50%.

In aircraft and other light metal industries — wherever tooling cost is an important operational consideration — HI-DEN has effected phenomenal savings. Forming, stretch, draw and press-brake dies, Yoder rolls, jigs, fixtures and pressure pads are but a few of the more than 100 successful applications of HI-DEN.

HI-DEN is a laminate of wood veneers impregnated with phenolic resin and compressed under extreme heat and pressure to approximately half its original thickness. The resultant composition — only 1/6 as heavy as steel — is about three times as strong as equal weight of steel yet is easily shaped with standard tungsten carbide tools.

It has high dimensional stability and is virtually impervious to oil and moisture. Used in forming tools, HI-DEN's low coefficient of friction eliminates scratching and burring. HI-DEN treats the metal better and results in far lower scrap.

Our Technical Bulletin and literature show how to get increased production of superior quality products — at lower cost — with HI-DEN. Send for it today.

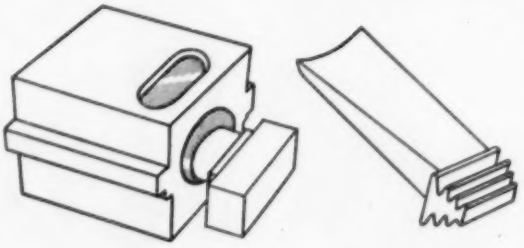
P.S. HI-DEN'S companion product, Parkwood 8000 (a kraft paper impregnated laminate) is widely used for cutting templates and bench tops. Smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloys and other softer metals.

Parkwood Laminates, INC.

32 Water St., Wakefield, Massachusetts

USE READER SERVICE CARD; INDICATE A-3-398-1

Hold irregular workpieces rigidly by nesting them in CERRO ALLOYS



The unique combination of low melting temperature and non-shrinking qualities in CERRO ALLOYS make them an excellent nesting matrix in jigs, chucks and fixtures for irregular shaped pieces. The illustration shows how a jet engine "pinetree" turbine bucket can be held snugly in a special fixture for grinding. After locating the bucket properly in the large cylindrical hole, the latter is filled with molten Cerro Alloy. After grinding the bucket, it is removed from the fixture by melting out the matrix in hot water. In such applications the low melting temperature of the Alloy eliminates all danger of annealing or burning the workpiece.

See you at Booth #848 Western Metal Exposition

Send for further information.

CERRO DE PASCO SALES CORPORATION

300 Park Avenue, Room 1503, New York 22, N. Y.

USE READER SERVICE CARD; INDICATE A-3-398-2

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THE ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 233.

THE ONE BEST WAY TO SELECT HEAT TREATING EQUIPMENT

Talk it over with the most experienced furnace experts you can find

That is exactly what we can offer you at Lindberg. A design and engineering staff concerned only with the development of equipment for applying heat to industry. This staff produces the most complete line of such equipment in the industry—heat treating furnaces, melting furnaces, ceramic kilns, high frequency induction units; big ones, small ones, electric or fuel-fired, built in our own plant or field-erected.

Whatever your requirements Lindberg's staff will study them without prejudice recommending the correct equipment to fill them whether you need only a simple heat treating furnace or a specially designed and developed installation to answer an exceptional problem in a newly-efficient way. You can be sure you have the right answer when you leave it to Lindberg. Get in touch with your nearest Lindberg Field Representative. (See your classified telephone directory or write us direct.)

This Lindberg Carbonitriding and Carburizing Furnace (electric or fuel-fired) is one of the most widely-used heat treating units in the world.

LINDBERG

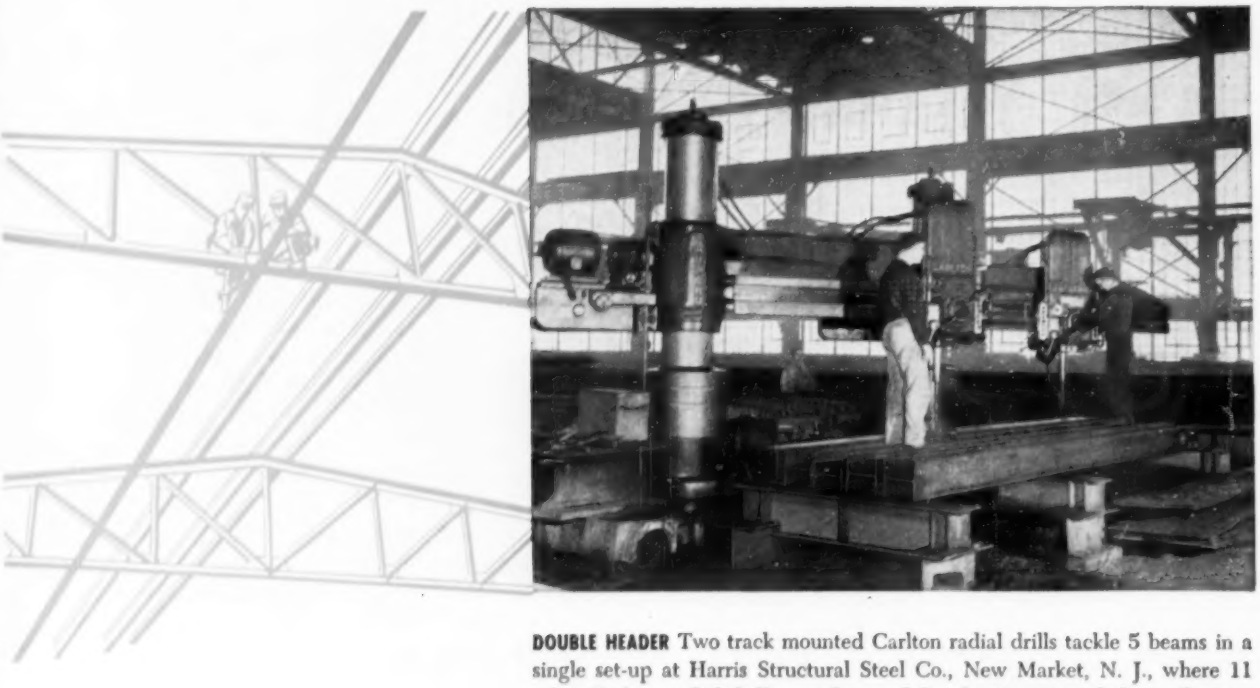
ENGINEERING COMPANY

2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.

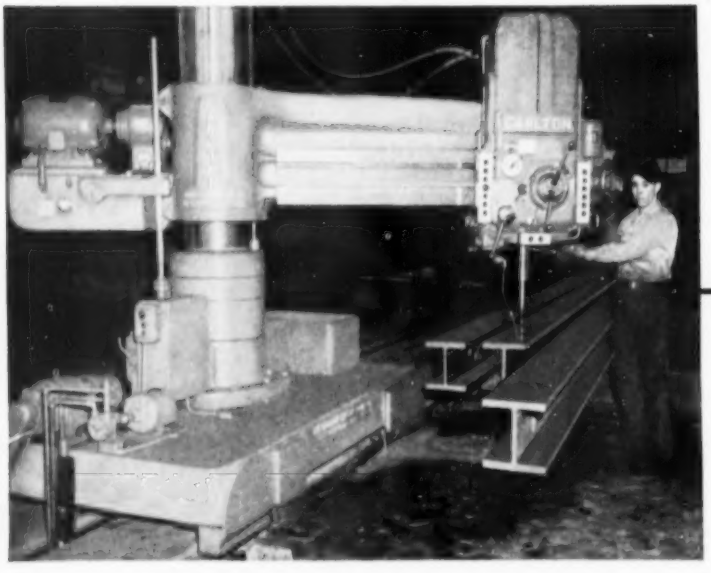
Canada—Elco Lindberg, Toronto

If You're at the Western Metal Show look in on Lindberg at Booth 478



DOUBLE HEADER Two track mounted Carlton radial drills tackle 5 beams in a single set-up at Harris Structural Steel Co., New Market, N. J., where 11 other Carlton radial drills are also used for this important hole production.

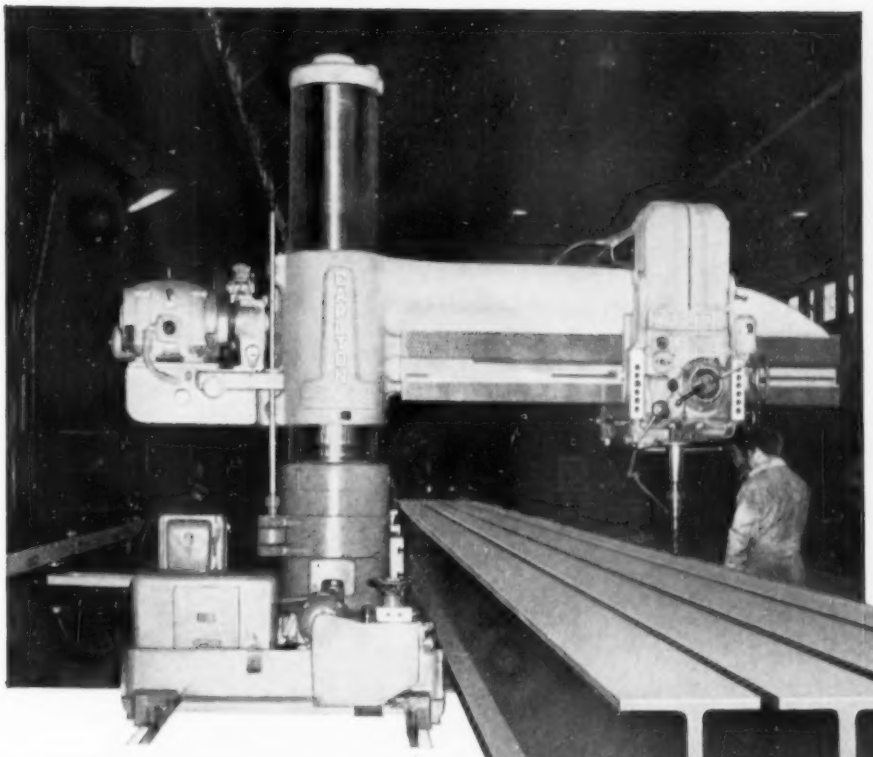
CARLTON'S on the
IN THE STRUCTURAL STEEL



Mobility, king size and engineering skill have made Carlton the leading radial drill in the structural steel industry. Special track mounting takes Carlton's drilling facilities up and down the entire length of even the longest beam. And Carlton's long arm reaches out over several beams.

In addition, Carlton has engineered several ingenious and inexpensive devices which make

MOHAMMED GOES TO THE MOUNTAIN It's smarter, easier and cheaper to bring the drill to the beams. And the Carlton radial drill on wheels is just the machine tool for the job. Drills through this heavy steel beam like so much cheese . . . and there's plenty of room for three or more beams under the long Carlton arm. Photo courtesy Ingalls Iron Works Co., Birmingham.



4 FOR 1 Paxton & Vierling Steel Company, Omaha, quadruples steel beam drilling with this Carlton 4A radial drill mounted on tracks. Cam rollers keep the arm always at 90° to the rails, and a measuring device on the head measures out the exact hole location on each beam from a "witness" or center line. This Carlton engineered set-up drills 4 huge beams, saves laying out each piece separately.

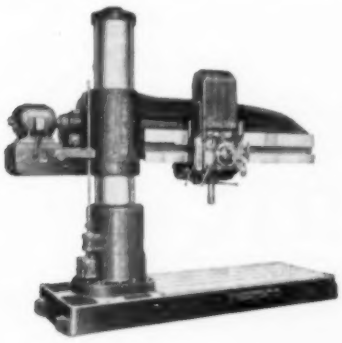
BEAM INDUSTRY

multiple beam drilling accurate, fast and practical.

Carlton brings every industry the advantage of

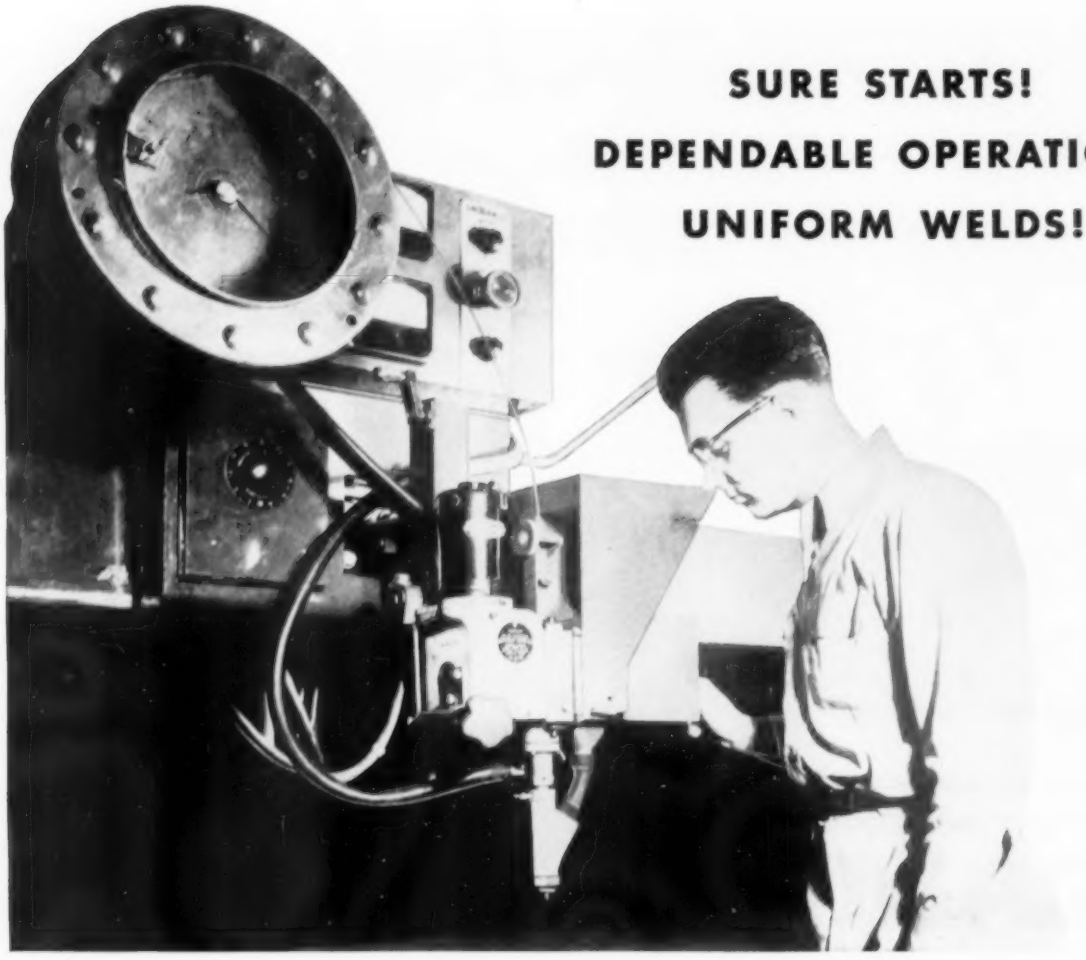
- a broad range of sizes: arm lengths from 3-ft. to 12-ft., column diameters from 9" to 26".
- a choice of three speed-feed control systems: programming, preselector and manual.
- an exclusive combination of standard features at no extra cost: 3-unit power clamping, low-hung drive, positive tooth feed clutch, and easy, economical operation and maintenance.

There's a Carlton radial drill for every drilling requirement. Write for descriptive bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



Carlton

specialists in radial drills



SURE STARTS!

DEPENDABLE OPERATION!

UNIFORM WELDS!

LINCOLNWELD

Automatic, Submerged Arc Welders

best for automatic production . . . structural fabrication . . . hardsurfacing

Write for Bulletin SB-1355 containing specifications and details.

gives you:

- uniform welds under irregular conditions
- choice of cold starts or hot starts
- infinitely variable and reversible inching speeds
- choice of DC, AC or engine driven power sources

easiest to adapt to any fixture.

THE LINCOLN ELECTRIC COMPANY

Dept. 5013, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

now, in air tools, too,

if it's Remington, it's right!

featherweight
midget collet die
grinder

works in
any place your
hand can reach!

The famous PG-K-1030L Die Grinder has 7 great features that make it right for you!

- Weighs just 12 ounces! 4 5/8" long. Only 5/8" from side to center of spindle
- 30,000 RPM. Powerful 4-bladed motor—not a turbine—holds speed under load
- Air exhaust to front of tool keeps work clean
- Erickson precision collet chuck—1/4" collet is standard. 3/64" to 7/32" collet furnished at no extra cost if specified
- No high pitched whine—exhaust muffled by patented noise silencer
- Chuck guard allows finger-tip control
- Choice of lever or locking-button throttle

Model PG-K-1030L *Midget Collet Die Grinder for use with mounted wheels, points and burrs. Complete with wrench set, collet guard, 8' length ¼" leader hose.*

Remington

Mall® **MALL TOOL COMPANY**
Division of Remington Arms Company, Inc.
25000 S. Western Avenue • Park Forest, Illinois

Electric Impact Wrenches . . .
"The Maintenance Handyman"

Super-versatile Flexible
Shaft Grinders

Specifications subject to change without notice

Congratulations to ASTE on Its Silver Anniversary

You boost production, cut costs on close, precision jobs . . . and with less worker fatigue in the bargain!

That's what plants all over the country are doing with this terrific little performer by Remington—the newest name in power tools and famous for 141 years for quality in sporting firearms and ammunition.

The PG-K-1030L is typical of our complete line of high efficiency air tools built for any power tool application. Let us tell you about them.

MALL TOOL COMPANY
Division of Remington Arms Company, Inc., Dept. C41
25000 S. Western Avenue • Park Forest, Illinois
Please send free catalog on Air Tools.

NAME _____

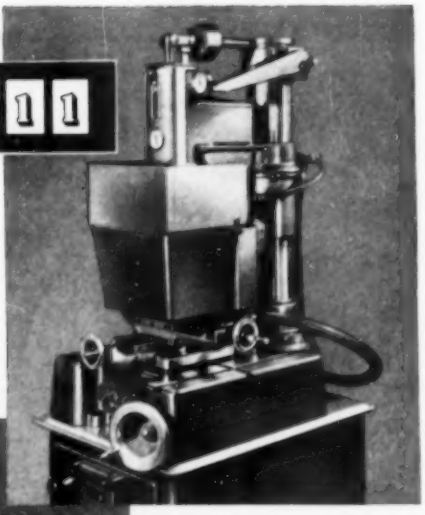
STREET _____

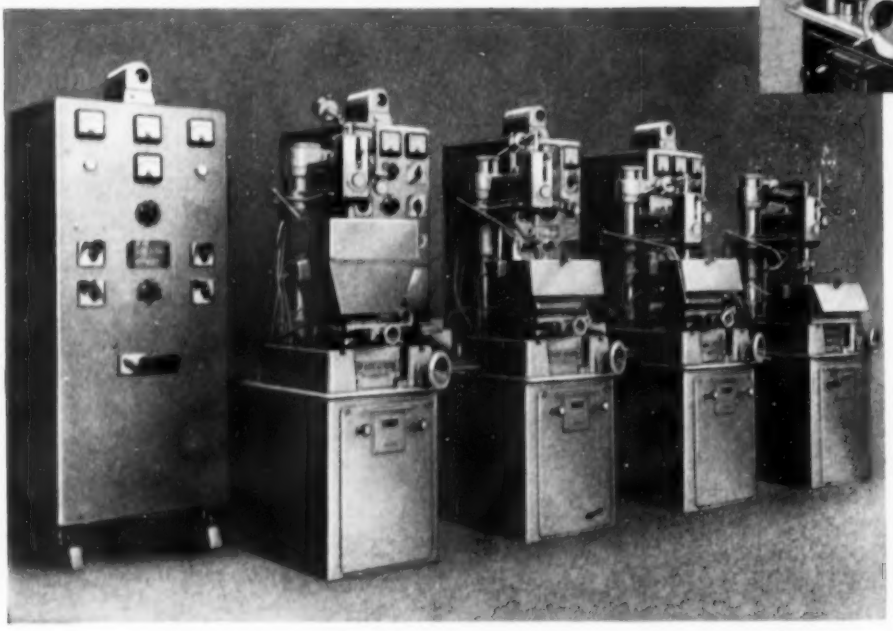
CITY _____ ZONE _____ STATE _____

SPARCATRON Mk. III

6.5kW

The greatest advance since SPARCATRON established spark erosion machining on a commercial basis





Up to four spark-heads can be operated from one control cabinet. The current is automatically cut off when the electrode has penetrated the workpiece to a predetermined depth allowing one operator to supervise a number of heads.

CAPABLE of operating three to eight times as fast as the Mark II model, depending on the type of material and finish required, the latest SPARCATRON spark erosion machine, Mark III, has exceptional accuracy and increased capacity. The new design also features ease of access for loading the table and setting the servo-head and the facility for quick and accurate alignment of the electrode. SPARCATRON affords the best means of "cutting" intricate shapes, profiles, forms, or impressions in both hard and soft current-conducting materials.

SP5

SPARCATRON

Pioneered and established in the toolmaking industry for spark-machining and reconditioning press tools and dies and wire drawing and extrusion dies in cemented carbides and hardened steels. There are extensive applications for "cutting", reconditioning or altering flat and tangential form tools and similar components.

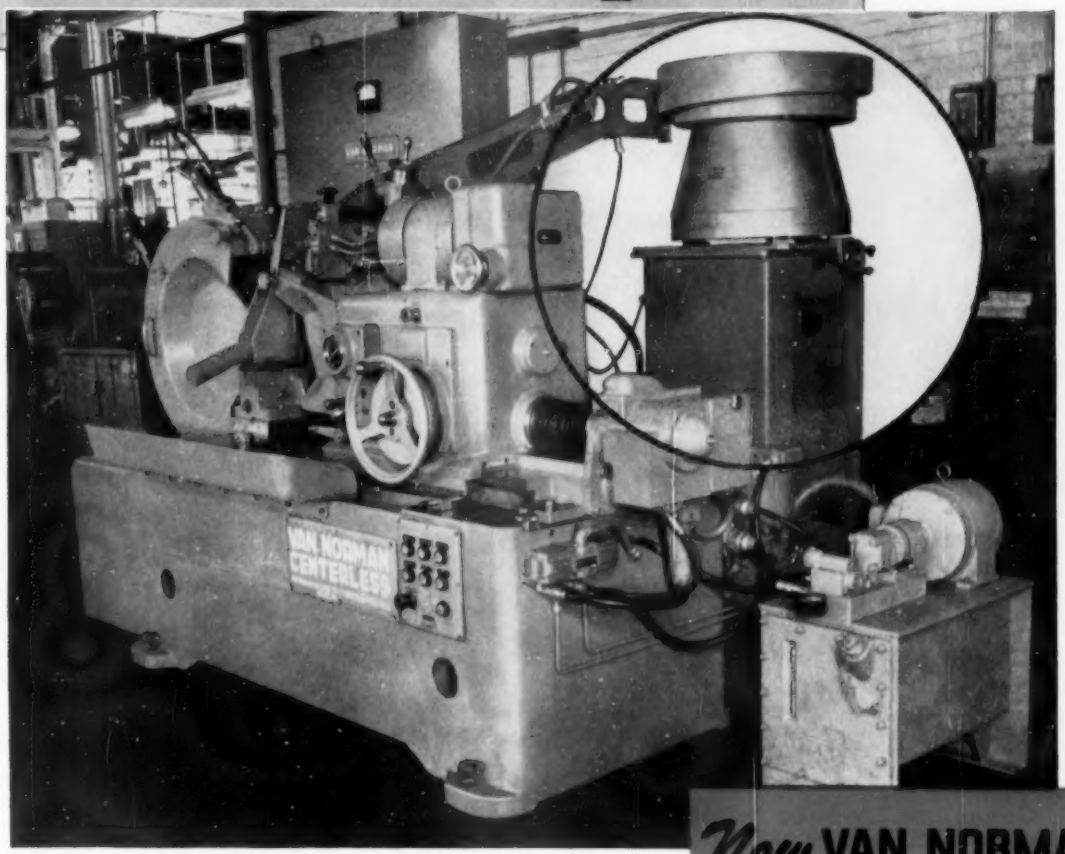
AVAILABLE FOR EARLY DELIVERY

B. S. A. TOOLS LTD.

228 Norseman St. Toronto 18, Ont., Canada

'PHONE BElmont 3-1209

PRODUCTION EQUIPMENT produces MORE with Peeco



Now VAN NORMAN MACHINE COMPANY production equipment includes DEVELOPED Peeco FEEDERS

As a leader in the field of vibratory parts feeders PEECO is contributing its share towards the greater capacities being achieved by new production equipment. We are glad to include, among the companies in this field now being served by PEECO, the Van Norman Machine Co. of Springfield, Massachusetts.

If you want to produce more, send for bulletin #356 and ask for the name of the PEECO representative in your area.

PEECO works with original equipment manufacturers to help engineer greater capacities into new production equipment. This Van Norman Centerless illustrates a single PEECO feeder (Model 25) installed with orientation track.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

Peeco PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • • • DIVISION OF AUTOMATION DEVICES, INC.

A-D

Now... Gorton Milling Machines Feature Hydraulic 3-Dimensional Controls

"Pencil Pressure" Does the Work

Gorton now offers you several models of Super-Speed Vertical Mills equipped with sensitive and accurate hydraulic controls featuring feeds up to 40 inches per minute.

AVAILABLE 3 WAYS

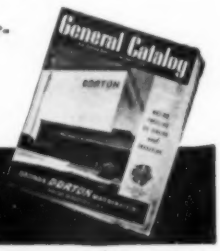
1. Vertical action only
2. Cross and longitudinal
3. Three-dimensional combination

Gorton Milling Machines with hydraulic Tracer Control must be ordered as such. Hydraulic equipment is not an attachment but a permanent installation.

For die or mold work (single or multiple units), production profiling and duplicating — short runs, experimental pieces or high production.

Gorton also offers manual and automatic Tracer-Controlled Milling Machines and Pantographs for 2- or 3-dimensional operation; 1 to 1 ratio, or reproduction at variable reductions, with single or multiple-spindle machines for work of any shape or size.

Shown above: Gorton 9-J Super-Speed Vertical Mill with True-Trace hydraulic installation.



Write for Form 2697-ADS and 2603 -1655 General Catalog.

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

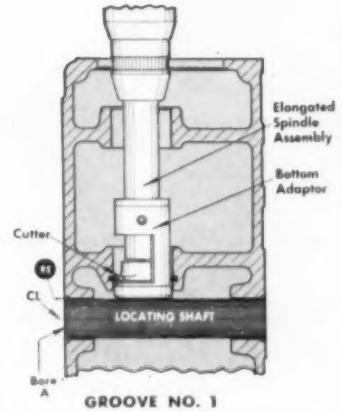
2603 RACINE ST. RACINE, WISCONSIN

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

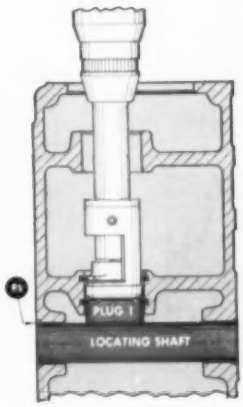
A 8731-1P

Waldes Truarc Grooving Tool pays for itself with big savings on one small run!

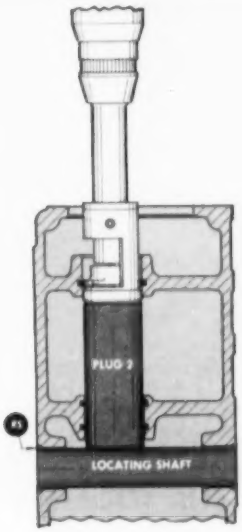
3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1



GROOVE NO. 2



GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

Groove No. 1: A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

Write for a 20-page manual containing full information on Waldes Truarc Grooving Tool.

WALDES

TRUARC®

GROOVING TOOL

U.S. Pat. 2,411,426.

WALDES KOHINOOR, INC., 47-16 Austel Place, L.I.C. 1, N.Y.

Waldes Kohinoor, Inc.
47-16 Austel Pl., L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

TE 02

FREE... 64 PAGE CATALOG

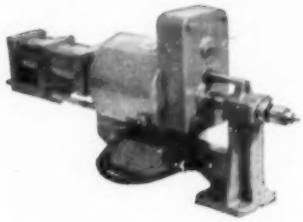
WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
write for your copy—TODAY!

JERGENS TOOL SPECIALTY CO.
Dept. TE-3, 712 E. 163rd St., Cleveland 10, Ohio

USE READER SERVICE CARD; INDICATE A-3-408-1

AUTOMATIC DRILL UNITS
for AUTOMATION



MODEL 111—3/32" CAPACITY	MODEL 113—¼" CAPACITY	MODEL 603—½" CAPACITY
1000 to 10000 RPM or 2500 to 15000 RPM CONTINUOUSLY VARIABLE SPEED CONTROL	15 SPEEDS 790 TO 15,800 RPM	600 to 4000 RPM WITH VARIABLE SHEAVES

ELECTRIC MOTOR SPINDLE - AIR HYDRAULIC FEED

Write for More Descriptive Bulletin

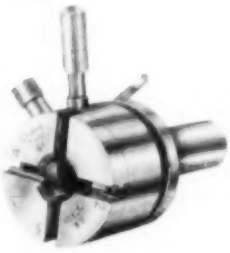
The ELECTRO-MECHANO CO.
175 E. Erie St. Milwaukee 2, Wis.

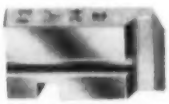
USE READER SERVICE CARD; INDICATE A-3-408-3

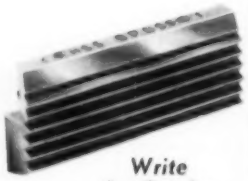
CUTTING and CHASING THREADS?

CHASO'S chasers and self opening die heads offer the fast economical way to do production threading.

CHASO manufactures all types of chasers including tangent, circular and radial in both cut thread and ground thread for most makes of die heads. Solid adjustable taps and chaser sharpening fixtures are also available.







Chaso Chasers are guaranteed to perform satisfactorily and at a savings in your threading costs.

Write For Catalog today

When you think of chasers think of CHASO.
MANUFACTURING CHASERS FOR 25 YEARS

CHASO TOOL CO. INC.
PHONE 2210
BOX 268A NORTH BRANCH, MICH.

ASTE DATA SHEETS

USE READER SERVICE CARD; INDICATE A-3-408-2

MIDDLESTADT -- BALTIMORE

TOOLS - DIES - FIXTURES
SPECIAL MACHINERY
PRECISION MACHINING

DESIGNERS - MANUFACTURERS

Write for New Descriptive Brochure

The Middlestadt Machine Co.

4210 Chesmont Ave. Baltimore 6, Md.

USE READER SERVICE CARD; INDICATE A-3-408-4

DIE BOOK
CONTAINS CONDENSED PRACTICAL AIDS FOR EXPERIENCED **DIE MAKERS**

Revised Edition Contains Answers to Over 1000 Practical Die Problems With Use of Direct Reading Tables and Formulas.

ALL IN ONE COMPACT HANDBOOK... direct answers to die problems. Saves time. Eliminates mathematical calculations. Avoids costly errors. Contains invaluable formulas and tables for quick reference.

Formulas and Direct Reading Die Tables on the following types of dies: Bending and Forming Dies, Blanking Dies, Drawing Dies, Square and Rectangular, Drawn Shells, Miscellaneous Tables and Charts.

CUT OUT THIS AD TODAY!
Paste on card and enclose **$4.50** for single copy. $4.00 for six or more copies. *Ten Days Free Examination.*

DIE TECHNIQUES, Publishers
5005 W. LAKE STREET • CHICAGO 44, ILL.

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Maker of Casters Gets Good Results with Water-Hardening Steel

The Bassick Company, Bridgeport, Conn., a leading manufacturer of casters, needed a good grade of tool steel for the dies and punches used in producing caster stems. They took the problem to Lindquist Steels, Inc., their local tool-steel distributor, who recommended Bethlehem W-1 Carbon Water-Hardening tool steel for cold-heading purposes. The performance of this grade, with its controlled hardenability, has been excellent.

The dies and punches, some of which are illustrated above, are hardened to about Rockwell C-60, and work on Bethlehem Cold-Heading Wire. They have proved economical, as their service life is approximately 100,000 pieces.

Bethlehem Carbon Water-Hardening tool steel has high shock-resistance because it is carefully controlled for hardenability. Besides, with its controlled carbon range, it has good resistance to wear, plus the toughness to withstand cold battering.

There may be one or more applications in your shop where Bethlehem Carbon Water-Hardening tool steel could be used to advantage. Why not talk it over with your Bethlehem tool steel distributor?

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Bend Tool Steels While They're Hot

The structure of machinery is such that parts are sometimes fabricated of steel which has been cold-bent to shape. However, when some of the components are made of tool steel, bending usually cannot be done at room temperature without causing breakage. Some degree of heating must therefore be employed.

For severe bending, such as bending to a small diameter, the tool steel is usually heated to the full forging temperature. Depending upon the grade, this may be 2000 F or higher. Moderate bending (curving into a shape similar to a leaf spring) can take place after heating to about 1300 F, being careful that the maximum temperature reached does not exceed the critical temperature. Very light bending operations (perhaps bending a shear blade to compensate for expected warpage in heat-treatment) can be accomplished at room temperature if a generous radius of curvature is used.

Making 36-lb Nut Behave

Here is a shaving die, made of Lehigh H tool steel, used in hot-broaching the sides of a 4¼-in. hexagon nut. Lehigh H is our special-purpose high-carbon, high-chromium grade of tool steel. Its excellent wear-resistance and red hardness make it an ideal steel for this application.

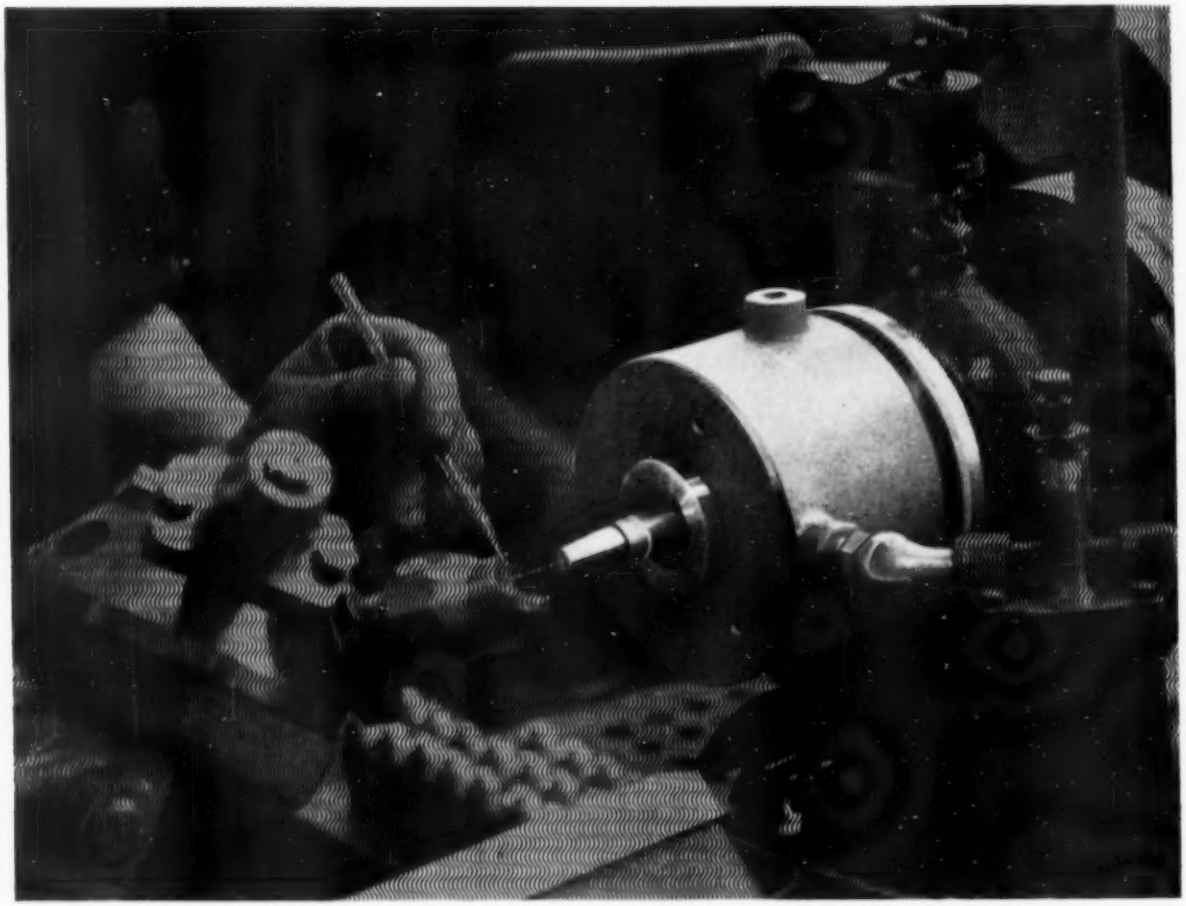


Photo: Courtesy Harris Calorific Company, Cleveland, oldest and largest independent producer of gas welding and cutting equipment in the country.

ERICKSON AIR CHUCKS

a hot tip for cutting costs on cutting-torch tips

Erickson '09 Model Air Chuck for heavy work. Quick-acting air chuck, with leverage principle, gives 3 to 4 times holding power of ordinary chucks.

"We have used Erickson Chucks since 1942 . . . and would recommend Ericksons to any plant which wants to increase production . . ." That is the report from Harris Calorific Company, big-name manufacturer of gas cutting and welding equipment.

The company uses four No. 400 Erickson Air Chucks for finishing leaded copper cutting-torch tips. Operations consist of drilling, reaming and polishing—at the rate of approximately *100 pieces per hour per chuck*.

Compared to previous methods, Harris Calorific Company claims, trueing-up time has been cut 70% . . . chucking time 60% . . . set-up time 25%.

Let an Erickson representative show you how to cut your production costs—*accurately*—with Erickson Air Chucks.

AA-4109

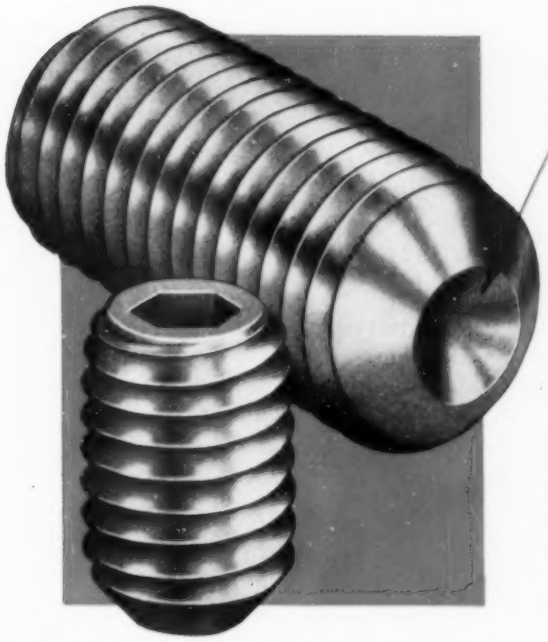
Bothered by a tough holding problem? Then let us show you how Erickson holding tools speed production, lower costs. Call us or write for Catalog K.

ERICKSON TOOL COMPANY

2303-9 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS
FLOATING HOLDERS
TAP CHUCKS
TAP HOLDERS

AIR-OPERATED CHUCKS
EXPANDING MANDRELS
EXPANDING-COLLETS
SPECIAL HOLDING FIXTURES



ALLENPOINT will give you a bulldog grip at no premium in price!

Allen's scientific redesign of the cup diameter on set screws gives greatly increased resistance to *withdrawal* torque. You can count on Allenpoint Set Screws to stay tighter longer, under heavy strain and vibrations. This dependable premium performance of Allenpoints is yours to use without increasing the cost of manufacturing your products.

Uniform Class 3A Threads

Allenpoints' smooth, uniform threads prevent off-lead conditions like Fig. 1. With Allenpoints, you have full, even contact between the engaging flanks of the threaded members (Fig. 2) —and a tight friction lock over the entire length of the Allenpoint Set Screw.

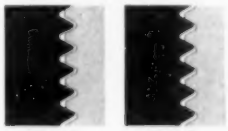
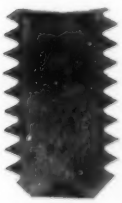


Fig. 1 Fig. 2

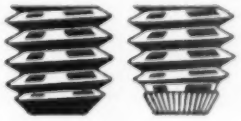
Strong, clean, deep sockets allow full wrenching leverage



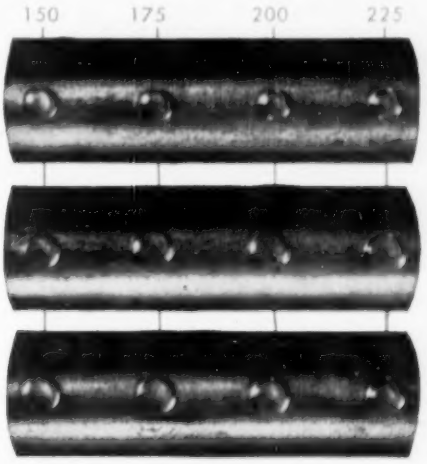
Sockets of Allenpoint Set Screws are cold forged to produce a deeper, smoother socket. No broach chips to interfere with proper seating of the key. This "pressur-forming" preserves the long steel fibers throughout the length of the screw—stronger walls allow maximum tightening torque.

One more full thread on ALLENPOINTS!

Allenpoint Set Screws have one more full thread than serrated point set screws. That means more holding power—especially important when you're using short lengths.



ALLENPOINT's performance compared for you



These actual-size, unretouched photographs show the cup pattern made by Allenpoints, serrated points, and A.S.A. standard cup point set screws in a 3/4" steel shaft. At each degree of tightening force, Allenpoints make a full circle pattern, penetrating deeper for greater holding power.

We'll be glad to send you more information and samples of Allenpoint Set Screws and other Allen Socket Screw products.

Stocked and sold by leading industrial distributors everywhere

ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

ALLEN HEAD

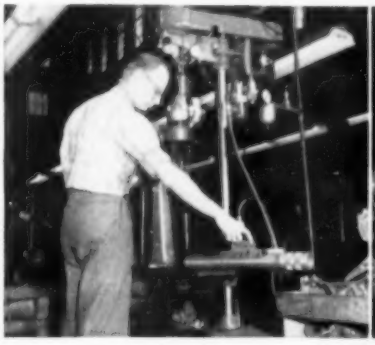
Gardner-Denver... Serving the World's Basic Industries

At this drill press station, four Keller Tool "Airfeedrills," with five-, six- and eight-inch strokes, drill four extra holes in the workpiece as the drill press finishes one hole from above.

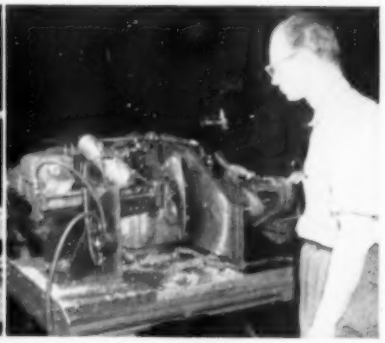
Drills 4 extra holes . . . production time: zero!

Production men have found a new and ingenious way to complete drilling operations with no extra production time. When a workpiece has to be jigged or put in a drill press for some operation, they mount Keller Tool "Airfeedrills"® in position to perform additional drilling, reaming, tapping or facing operations at the same time. The illustrations on this page show how it's done.

Ideal for mounting in multiple units or as single outriggers, Keller Tool "Airfeedrills" and "Airfeedtappers"® perform complete work cycles automatically—at the press of a button. Further details are available in Bulletin 92.



Operator presses a button—and the Keller Tool "Airfeedtapper" provides a free tapped hole while standard machine taps three holes at top of piece.



While special multiple head unit drills eight holes in the work, an "Airfeedrill" mounted at rear of fixture step drills a "free" ¾-⅝-inch hole at an odd angle.

GARDNER-DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

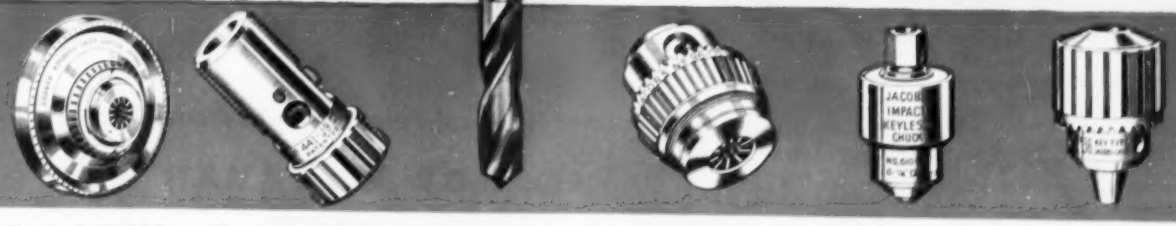
Jacobs

CHUCKS

Grip and accuracy are the products of perfectly made and matched parts.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company
West Hartford, Connecticut



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

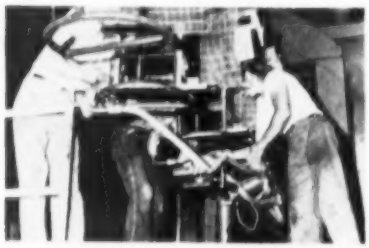
The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

JOIN WITH HANDY & HARMAN SILVER BRAZING FOR PERMANENT PROFIT

After brazing, the assembly undergoes the first of four leak tests in a water-filled tank. It is then given a carefully controlled dehydration and vacuum test.



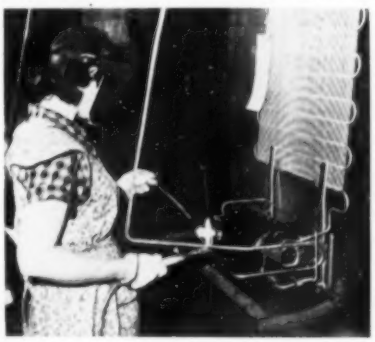
To further insure that the vacuum is maintained, the assemblies enter a helium atmosphere; the smallest leak would draw helium into the system.

Next they are tested by the spectrometer which is calibrated to detect a concentration of helium equivalent to a leak rate of one ounce of refrigerant in 200 years.

How to Join Refrigerator Tubing So It Won't Leak

Hotpoint Company's new refrigerator assembly plant in Chicago boasts one of the most advanced mass-production assembly line operations in the industry. It boasts, also, one of the most stringent quality controls in the industry—with 83 quality checks and tests during manufacturing. Four of these tests are positive checks for hermetic sealing, the most exacting being the mass spectrometer test which can detect a potential leak of one ounce of refrigerant in 200 years.

To a great degree, hermetic sealing depends on the quality of the joints in the tubing connecting the major components of the system . . . Hotpoint's are silver brazed with Handy & Harman's EASY-FLO 45 and HANDY FLUX. Some of these joints are copper-to-copper, others copper-to-steel and the rest steel-to-steel; all are EASY-FLO brazed and have a tensile strength of 30,000 psi.



These gruelling production checks are met, basically, with a 3/64" silver alloy wire, double-tipped hand torches fueled by a mixture of natural gas and oxygen, and HANDY FLUX. These are the ingredients of EASY-FLO brazing used by Hotpoint in assembling their refrigeration units. Simple, isn't it? And all the more remarkable in view of the tests the brazed joints must pass.

A joining method this simple, this fast, this economical and this strong warrants your consideration for your product. Ask us for all the facts.

SEND FOR BULLETIN 20

BULLETIN 20 tells you why high strength, speed and economy are inherent in EASY-FLO brazing. Also gives Handy information about joint design and fast brazing methods. We'll be pleased to send you a copy.

Your NO. 1 Source of Supply and Authority on Silver Brazing Alloys

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

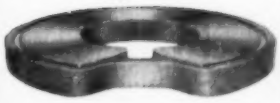
DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES and PLANTS
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

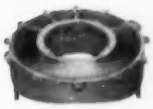
NOW

BUILD YOUR OWN PRODUCTION MACHINES WITH HARTFORD "OFF-THE-SHELF" COMPONENTS

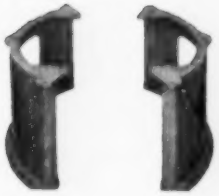
Columns



Circular Base Top

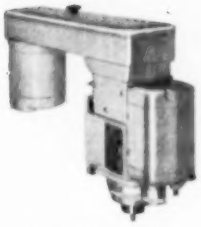


Index Table Support

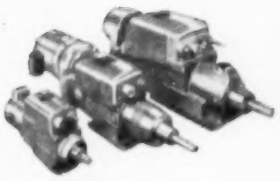


Pedestals

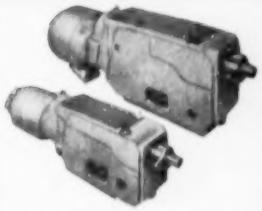
Unit Mounting Adapters



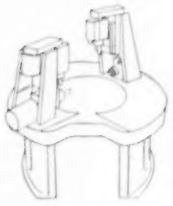
Integral Motor Mounts

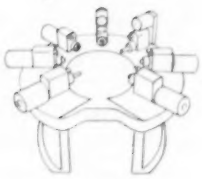


Automatic Air-Hydraulic Drill Units

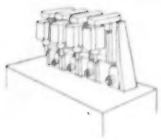


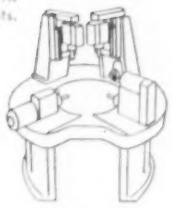
Automatic Cam Type Drill Units





Four of the many machine setups possible with Hartford Components.





HARTFORD SPECIAL now offers a complete high production automatic processing machine in knock-down form, ready for assembly on your floor. The production-tested components and elements illustrated above are available from stock, and are the same standard machine equipment from which Hartford's line of complete automatic drilling and tapping machinery is made.

For the plant that is plagued by model changes or setup costs, these preengineered components can offer unlimited time and cost saving. "Building block" construction allows you to build a production machine to your own design or needs on the spot, when and where you need it. Call in Hartford now, and take advantage of our offer to produce better products at lower cost through better methods.

Hartford also makes automatic Thread Rolling Machines, Special Machinery and the world famous Super-Spacer.

HARTFORD Special

Machine Tool Division
THE HARTFORD SPECIAL MACHINERY CO.
2803 Homestead Ave., Hartford, Conn.

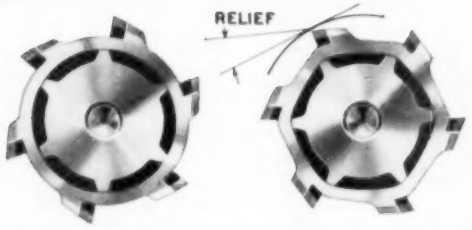
Send me data sheets and complete information on your "off-the-shelf" components.

Name _____

Company _____

Street _____

City _____ Zone ____ State _____



Bending of the tool body in expansion automatically provides clearance.

With Each Expansion, You Get A New Cutting Edge

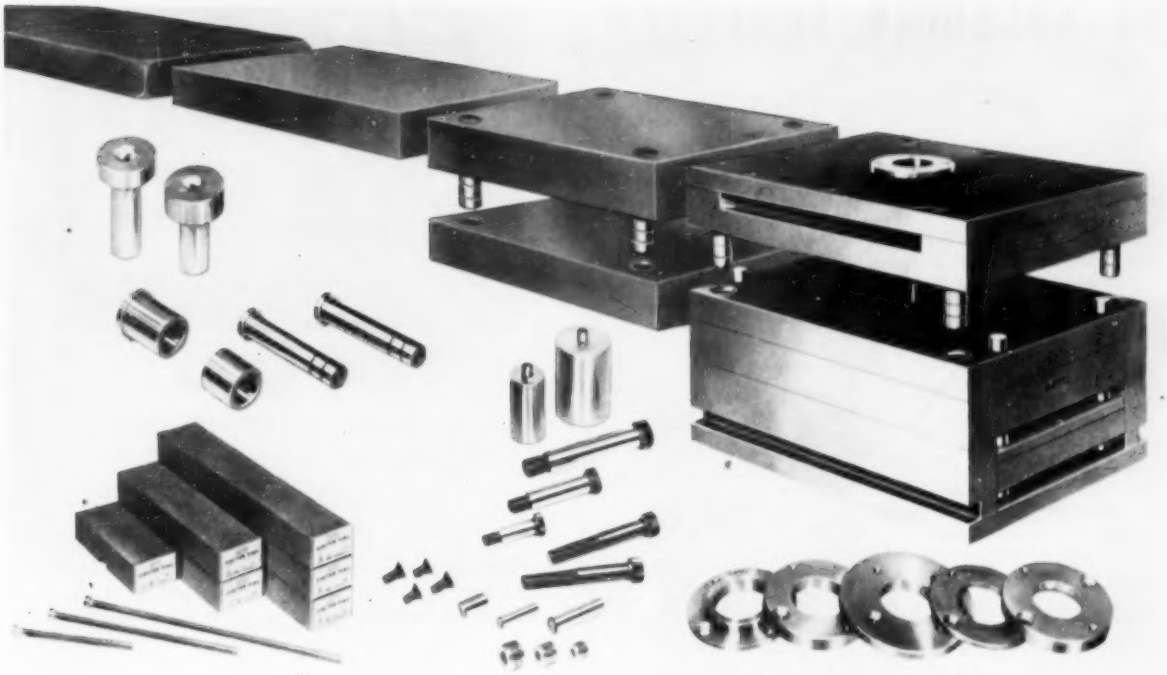
There's extra rigidity and accuracy in these Staples Expansion Reamers. Tool bodies are solid—not split. Expansion plugs, contacting well beyond the rear of the tips, apply uniform parallel pressure.

. . . Write for a catalog of Staples Precision Carbide Tools.

Staples
CARBIDE TOOLS

THE Staples TOOL COMPANY

2352 Glendale—Milford Road, Evendale, Cincinnati 15, Ohio



PROGRESS IN PLASTICS . . .

. . . and how DME "helped"

The history of economy in modern business has been directly related to the history of Standardization. One of the major elements affecting the economic production of finished plastic parts is the high initial cost of the mold. A progressive step in reducing mold cost, without sacrificing the high quality required, has been successfully achieved through Standardization.

When D-M-E originated Standard Mold Bases and their component parts in 1942, it provided the answer to the rapidly growing demand for high quality molds that would maintain and promote the economic advantages of plastic parts.

Through large volume purchases of quality steel in standard sizes and specialized production facilities, D-M-E was able to produce and supply high quality Standard Mold Bases to mold makers and molders at such great savings in cost and time that the benefits of Standardization were quickly realized by the Industry.

Today D-M-E produces twenty-eight different sizes of Standard Mold Bases, from 9" x 8" to 23¾" x 35½", in either D-M-E No. 1 or No. 2 Steel, with a wide range of cavity plate thicknesses to satisfy the diversified demands required. In addition, over 2,000 finished component parts of the same high quality are available to provide additional savings in service as well as in the product.

Properly engineered Standardization puts the accent on Economy. When you "Specify D-M-E . . ." you get Quality, Service AND Economy!

DETROIT MOLD ENGINEERING CO.

6686 E. McNICHOLS ROAD — DETROIT 12, MICHIGAN — TWinbrook 1-1300

Contact Your Nearest Branch FOR FASTER DELIVERIES!

Specify **D-M-E** *for*

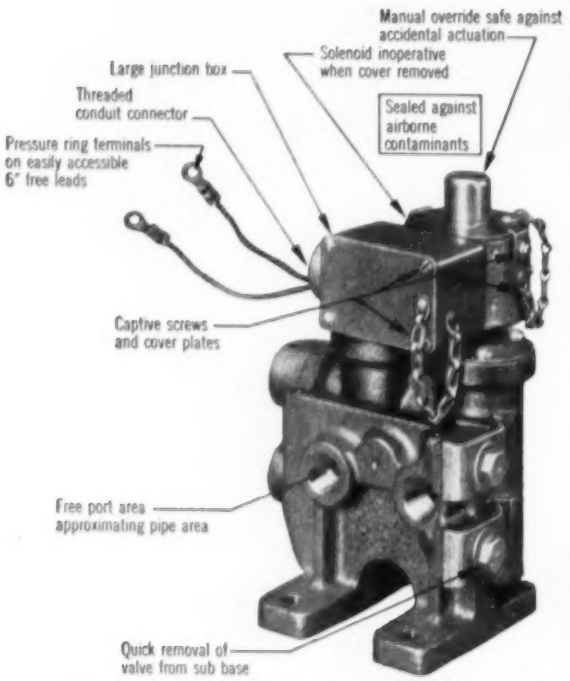
QUALITY . . .
SERVICE . . .
ECONOMY!

HILLSIDE, N. J. (NEAR NEWARK) 1217 CENTRAL AVE., ELIZABETH 3-5840
CHICAGO 51, ILLINOIS 5901 W. DIVISION STREET, COLUMBUS 1-7855
CLEVELAND 9, O. - D-M-E CORP. 502 BROOKPARK RD., SHADYSIDE 1-9202
LOS ANGELES 7, CAL. 3700 SOUTH MAIN STREET, ADAMS 3-8214

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-417

NO SOLENOID TROUBLES

with Crescent® Valves


Manual override safe against accidental actuation
Solenoid inoperative when cover removed
Large junction box
Threaded conduit connector
Sealed against airborne contaminants
Pressure ring terminals on easily accessible 6" free leads
Captive screws and cover plates
Free port area approximating pipe area
Quick removal of valve from sub base

®Product of Crescent Valve Company for the control of air, water and light oil to 150 P.S.I.

Pointed out on the photo above are the JIC features which are a must for many equipment manufacturers to gain acceptance of their machines in a growing number of production conscious plants. However, they offer obvious advantages even where they are not specifically demanded. Furthermore the JIC type Crescent solenoid is completely interchangeable with standard solenoids for the convenience of those manufacturers who want the JIC features available only for required application.

COMPETITIVE

With all its superior operating features the Crescent valve is probably the most competitively priced line on the market, particularly in the light of liberal trade and quantity discounts.

COMPACTNESS

Space, labor and materials savings have been pointed out to us by many equipment manufacturers as benefits from Crescent's compact design.

INTERCHANGEABILITY

Crescent valves can be converted to any practical current or voltage AC or DC by a simple coil change.

NO COIL BURNOUT

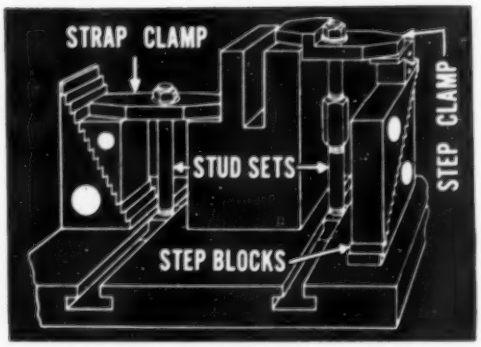
Short stroke, pilot operation and a generous power margin prevent overheating, overloading and the resultant coil burnout.

Write for Catalog 6-C

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

USE READER SERVICE CARD; INDICATE A-3-418-1



TTCO

Sure Grip STEP BLOCKS, STRAP CLAMPS and STUD SETS

—This combination is the last word in clamping . . . also

T-Nuts • Hand Knobs • Quarter Turn Screws • Fixture Keys • Tooling Balls Studs • Height Gages • and Die Checkers

Represented in all principal cities
Ask your Dealer or write Dep't. TE

TIETZMANN TOOL CORP.
315-317 N. Main Street ★ Englewood, Ohio

USE READER SERVICE CARD; INDICATE A-3-418-2

Wells Roto-Veyor

AUTOMATIC BAR FEED

The Wells Roto-Veyor is an entirely new concept in automatic bar feeds. Designed specifically for use with the Wells Model 1200 Band Saw, the Roto-Veyor converts it into a heavy duty completely automatic cut-off machine.

All conveyor feed rollers are mechanically powered —electrically controlled. The Roto-Veyor is capable of unlimited projection length. Feed mechanism and stock clamping action is synchronized with the saw to provide accurate repetitive cutting.

The Roto-Veyor will improve the saw's efficiency, save time, and reduce production cutting costs. *Write today for complete information.*

Wells SAWS
Wells®

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
600 Service Road, Three Rivers, Michigan

USE READER SERVICE CARD; INDICATE A-3-418-3

HERE'S EASY, INEXPENSIVE AUTOMATION

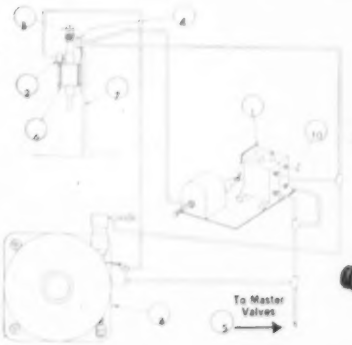
YOU can reduce your cost of making small parts!

Standard Mead units combine easily to make automatic special machines, with little or no engineering.

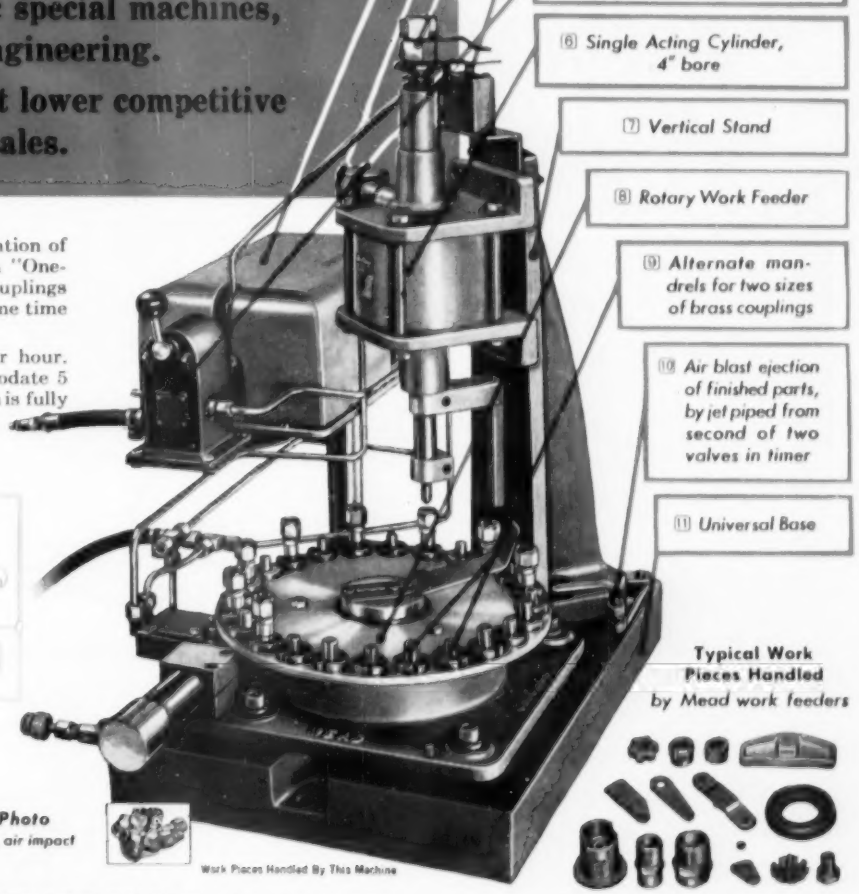
Lower costs permit lower competitive prices, increased sales.

A simple and inexpensive combination of Mead pneumatic devices makes a "One-Man Factory" to assemble brass couplings by flaring neck into nut, at the same time forming a fluid-tight seat.

Output approximately 2500 per hour. Two sets of 12 mandrels accommodate 5 different styles and sizes. Operation is fully automatic except for loading.



Circuit Diagram of Units in This Photo
Combine readily to feed work to drill press, air impact hammer for a wide variety of operations.


[1] Model 2 Meadmatic Timer
[2] #2 Quick Exhaust Valve to speed up return stroke
[3] Adjustable depth stop with spring return
[4] Cycle release valve (included with timer) to reverse cycle at end of down stroke
[5] 4-B Master Valve starts and stops entire system
[6] Single Acting Cylinder, 4" bore
[7] Vertical Stand
[8] Rotary Work Feeder
[9] Alternate mandrels for two sizes of brass couplings
[10] Air blast ejection of finished parts, by jet piped from second of two valves in timer
[11] Universal Base

Work Pieces Handled By This Machine

Typical Work Pieces Handled
by Mead work feeders

MEAD SPECIALTIES COMPANY, Dept. T-37, 4114 No. Knox Ave., Chicago 41, Ill.

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., T-37, Chicago 41, Illinois

Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Now semi-finish machined all over

to save your machining time and reduce waste

AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS

Ampco Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and O.D. sizes to which bars finish.

14 New Sizes! Sizes now range from 1¼" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling — and get other sizes promptly from your nearby Ampco stocking distributor.

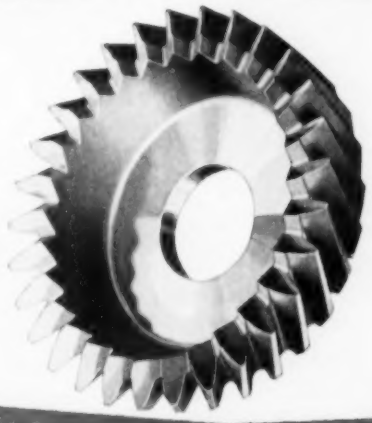
Write today for new stock list.

AMPCO METAL, INC.

Dept. TE-3
Milwaukee 46, Wis.
West Coast Plant
Burbank, California

D-588

Everybody knows that
National Tool Company
makes gear shapers—



But did you know
we make rotary
shaving cutters...

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one *special* tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of *special* tools for the metal-working industry.

Name_____

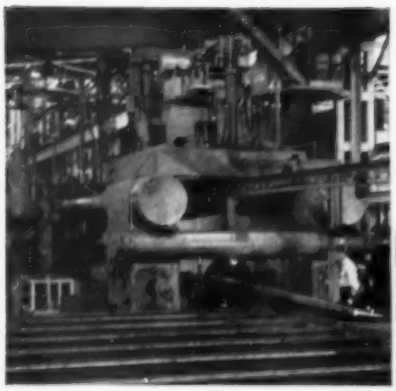
Position_____

Company_____

Address_____

City_____ Zone____ State_____

For the King and Queen of Extrusion Presses . . . it's FIRTH STERLING HOT WORK DIE STEEL



Giant press extruding an aluminum spar section.

2500 lb. die blanks and a finished extrusion die of Firth Sterling HWD Hot Work Die Steel.

At Kaiser Aluminum & Chemical Corporation's Halethorpe Extrusion Works, operated under a U. S. Air Force lease, are two 8,000 ton capacity extrusion presses—the largest operating units designed and built in the United States. Presently extruding large, complex aluminum shapes—wing spars, wing panel sections, and missile hull sections, for the aircraft industry, the two giant presses, named Rex and Regina, utilize dies made from Firth Sterling Hot Work Die Steel.

Yes, Firth Sterling HWD is a monarch in its own right, with properties capable of withstanding the tremendous pressures of this king and queen of extrusion presses. This intricate process requires materials that can operate continuously in volume production without replacement. These giant presses each weigh 1500 tons and are capable of extruding aluminum shapes more than 85 feet long and over 1200 pounds each in weight. The use of Firth Sterling HWD is tangible evidence of the high opinion modern die makers have of the quality of the material.

HWD Steel is just one of the Firth Sterling line of more than 50 Tool and Die Steels. Ask for a Firth Sterling engineer to cooperate in your next die making problem to assure the correct grade and analysis.

VISIT OUR BOOTH NO. 937-A
WESTERN METALS SHOW, LOS ANGELES

R-326

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD
OFFICES AND WAREHOUSES: BIRMINGHAM · CHICAGO · CLEVELAND · DAYTON · DETROIT · HARTFORD · HOUSTON · LOS ANGELES · PITTSBURGH · WESTFIELD, N.J.

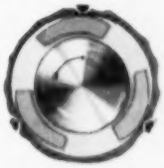
PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

Cincinnati Combines Quality Control and Production Control

for Your Precision Centertype Grinding

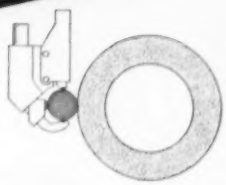
CINCINNATI FILMATIC
6"R x 18"
Plain Hydraulic Grinding Machine
Equipped with Quality Control and Production Control



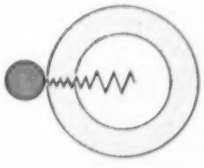
FILMATIC Grinding Wheel Spindle Bearings and Grinding Wheel Balancing are standard equipment. (FILMATIC principle illustrated above.) These two cost-reducing features alone are reason enough to choose CINCINNATI.

Every shop wants closer control of quality and production. It's especially desirable for final operations, when cost per unit nears its maximum. In the field of precision centertype grinding on 6" to 14" machines, Cincinnati's standard and extra features combine quality control and production control into a unified, automatic function of the machine.

The cost-control features illustrated at the right, and many others are outlined in two attractive catalogs: No. G-660-1 for the CINCINNATI® FILMATIC 6"R and 10"L Plain Hydraulic Grinding Machines. No. G-661 for the 10"R and 14"L Machines. Write for copies, or look in Sweet's for brief specifications.



Automatic Air-Electric Gage Sizing (extra) includes an exclusive CINCINNATI advantage . . . cycle time stabilizer for wheel wear and truing.



Gap Eliminator . . . greatly reduces time spent in "cutting air" during automatic infeed grinding operations. (extra)

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

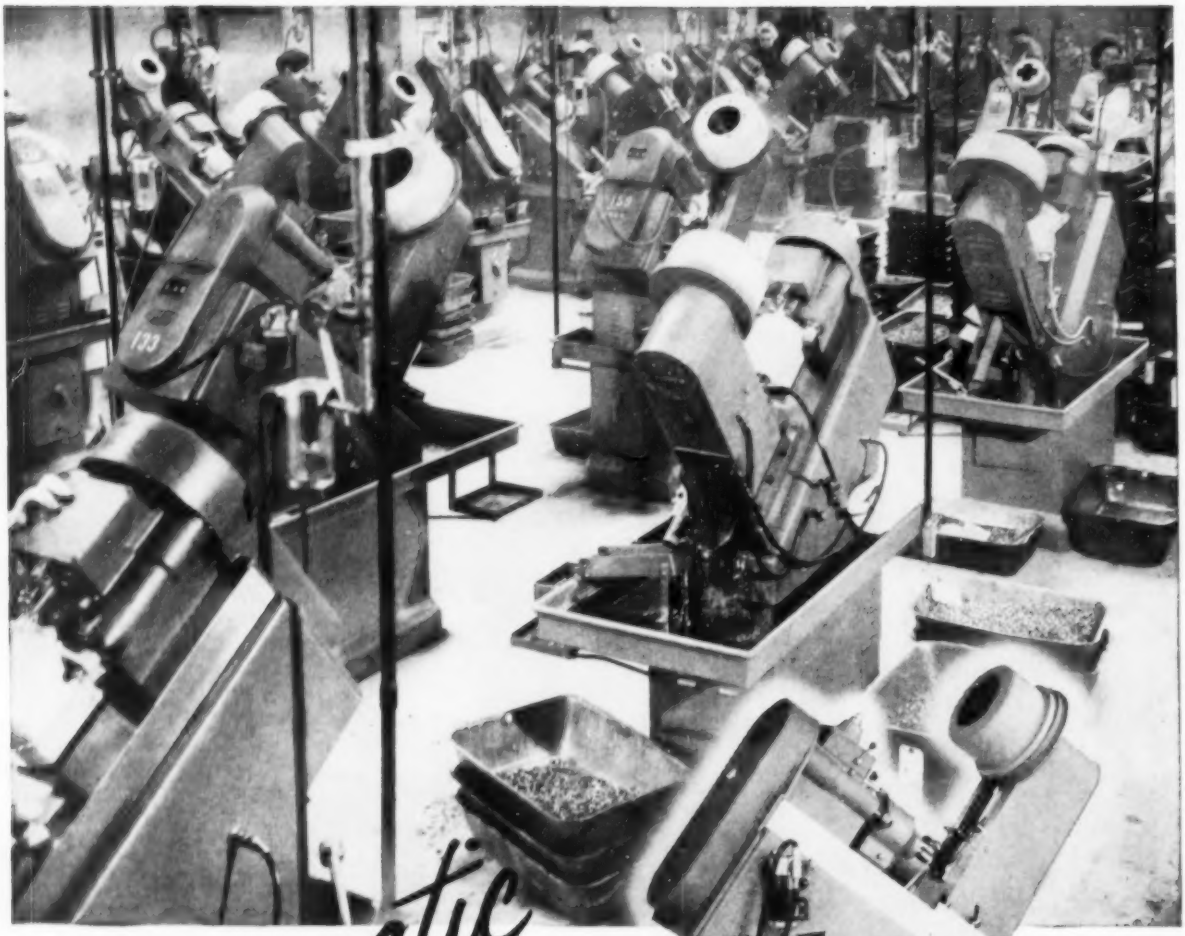
Members of this family group of CINCINNATI FILMATIC Plain Hydraulic Grinders are:

Size	Between-Center Lengths	Catalog
6"R } 10"L }	18" and 30"	G-660-1
10"R } 14"L }	18", 36", 48" 72" and 96"	G-661

CINCINNATI FILMATIC

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE • GRINDING MACHINES • CHUCKING GRINDERS
MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

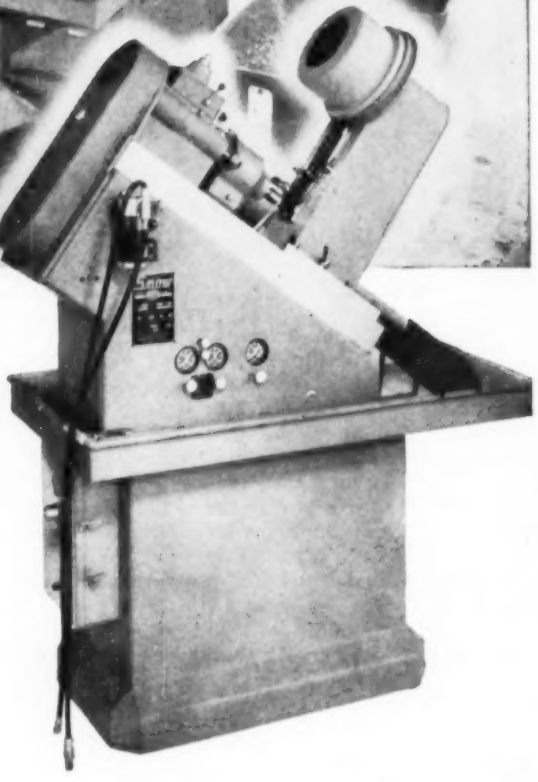


Automatic NUT TAPPING MACHINES

This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
VERTICAL THREADING MACHINES
TWO SPINDLE MACHINES
ANGULAR MACHINES
NUT TAPPING MACHINES
HORIZONTAL MACHINES
DRILLING AND TAPPING UNITS
AUTOMATIC JIGS AND FIXTURES
DRILL PRESS TAP HEADS



SNOW

MANUFACTURING COMPANY

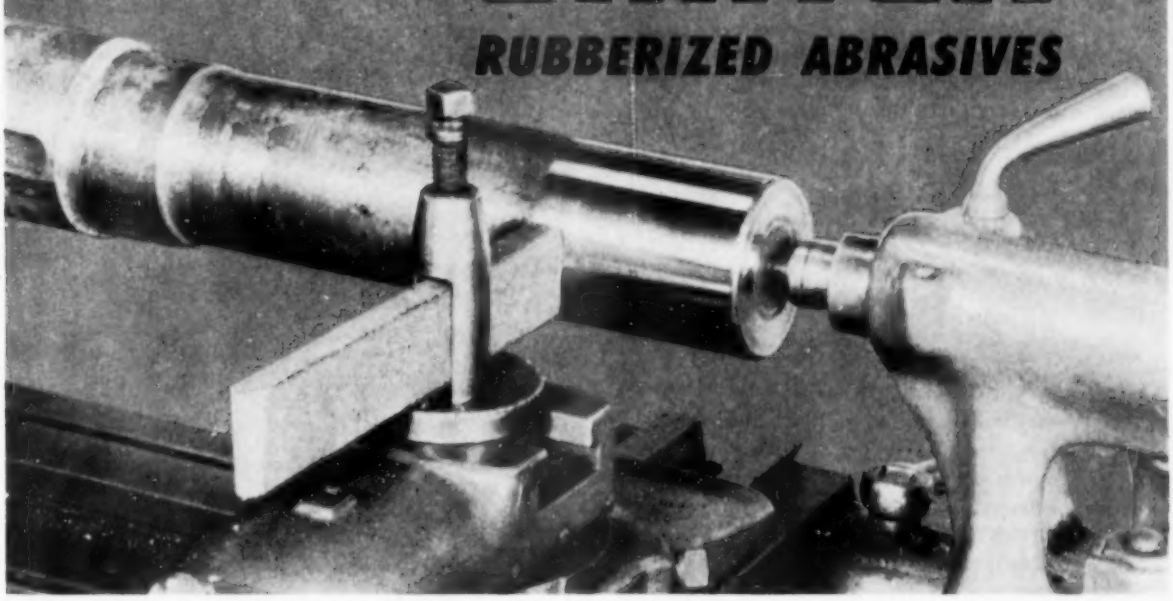
435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

SEE IMPROVED QUALITY AND IMPORTANT SAVINGS IN THE FINISH PROVIDED BY

CRATEX

RUBBERIZED ABRASIVES



MILK PROCESSING EQUIPMENT

Polishing hard to reach spots on stainless steel with grinding wheels and emery paper proved too slow with poor results. Cratex cones Nos. 1340-C, 1359-C, 1340-M and 1359-M produced a highly polished, scratch-free surface much faster. Easy cleaning and less danger of bacterial contamination resulted.

Field Application Report #121

CAST IRON PLASTIC MOLDS

Final finishing of molds for glass reinforced plastic articles was unsatisfactory for efficient pressure molding and product appearance. Cratex 112-M and 216-M wheels and 1358-M cones produced the required fine finish and greatly reduced or eliminated finishing on molded articles and improved product appearance.

Field Application Report #115

In virtually every metal working operation where a high degree of surface smoothness is required, Cratex Rubberized Abrasives lower costs and improve quality. They are used successfully on hard and soft metals . . . for deburring, smoothing and polishing . . . in tool and die shops . . . on production lines . . . and in the full range of machined and fabricated metal products.

Use Cratex to replace many slow, hand operations, to increase dimensional control, and to eliminate many multi-step operations. Cratex lowers costs, saves time and rejects because it finishes faster, more smoothly, and with minimum danger to tolerances. Order Cratex in Wheels, Points, Blocks, Sticks or Cones—in four grit textures.

TEST **CRATEX** IN YOUR OWN PLANT
WITH THIS NEW POLISHING KIT
24 ITEMS FOR ONLY **$12.50**

Wheels, Blocks and Cones in a variety of grit textures, to demonstrate how CRATEX can save you money and improve quality in your own operations.

☐ Here is our P. O. for the CRATEX Polishing Kit, at $12.50. (Will be sent thru industrial distributor in your area)

☐ Please send complete CRATEX catalog (Free)

Name

Company

Title

Street

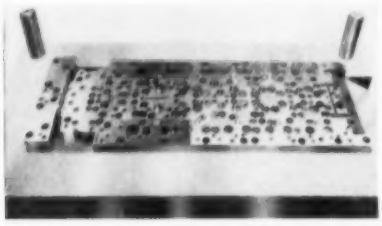
City Zone State

CRATEX MANUFACTURING CO.
81 Natoma St., San Francisco 5, Calif.

Holes

JIG GROUND with *Vulcanaire*

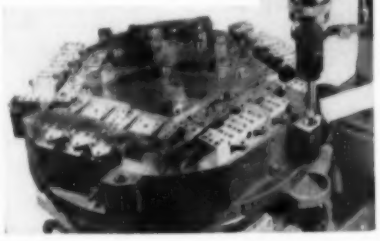
Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

Borrow our instructive 11 minute movie on Jig Grinding.



A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

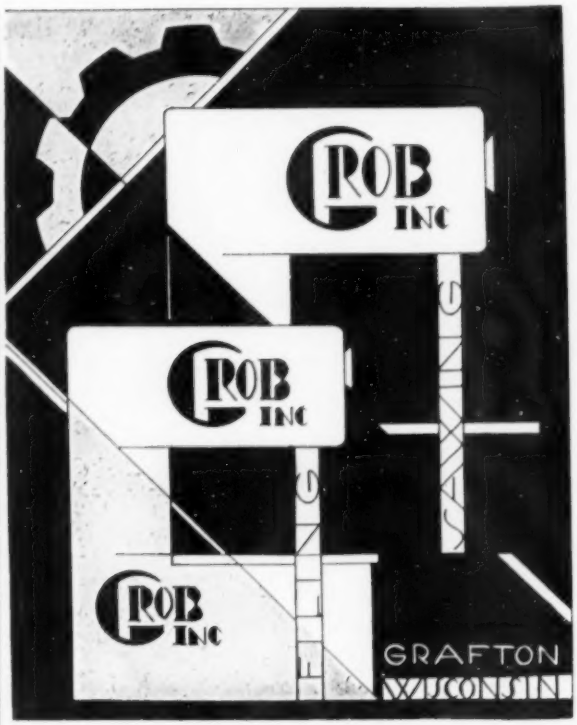
Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

7300 LORAIN • DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-3-426-1



USE READER SERVICE CARD; INDICATE A-3-426-2

Controlled Grinding of Tap Flutes and Chamfers

To Cut Your Tapping Costs, GRIND and RE-GRIND YOUR TAPS ACCURATELY!

Use these basic hook angles as a starting point for better tapping.

Aluminum	18°	Cast Iron	5°	Brass	5°
Copper	18°	Magnesium	18°	Plastics	8°
Mild Steel	8°	Stainless Steel	12°		

Write for specific details on how the BLAKE Flute and Chamfer Grinders give you the accuracy you need for low tapping costs.

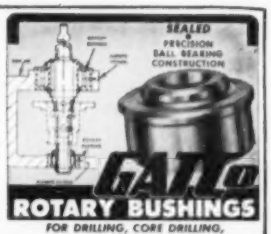
EDWARD **BLAKE** COMPANY INC.
452 CHERRY ST., WEST NEWTON 65, MASS.

USE READER SERVICE CARD; INDICATE A-3-426-3

USE
GATCO ROTARY BUSHINGS
WITH
Your Boring Bars
FOR
ACCURACY
and
SAVE WEAR

Eliminates expensive tool construction – Reduces tool wear – Prevents seizure and pilot breakage – Especially adapted where precision is required.

ORIGINATORS OF THE ROTARY BUSHING
GATCO ROTARY BUSHING CO.



ROTARY BUSHINGS
FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

42324 ANN ARBOR ROAD, U.S. 12
PLYMOUTH, MICH.
Telephone PLYMOUTH 1472

USE READER SERVICE CARD; INDICATE A-3-426-4

Acme-FETTE

NEW SERIES - "N" SELF-OPENING
THREAD ROLLING HEAD

lets you use your present equipment

(either rotating or stationary spindles)

for rolling threads from the end

VERSATILE—Same head can be used on any type of turning equipment—either rotating or stationary spindles—on all jobs which permit clearance for front plate. Reduces secondary operations.

FAST—Thread rolling speeds are equal to turning speeds with high-speed tool steels—on all ferrous and most non-ferrous materials; up to 5 times faster than conventional thread cutting methods.

SMOOTH, TOUGH, EXTREMELY ACCURATE—Metal flows to full depth of thread; forms a dense, uniform structure with no cratering at the crest; provides a burnished thread surface remarkably resistant to wear and corrosion.

NO CHIP PROBLEM—Thread Rolling with an Acme-Fette is ideally suited to multiple-spindle tooling setups.

FOR EITHER LONG OR SHORT RUNS—Production records (names on request) prove substantial cost savings due to easier setup, less down time and more mileage per set of rolls.

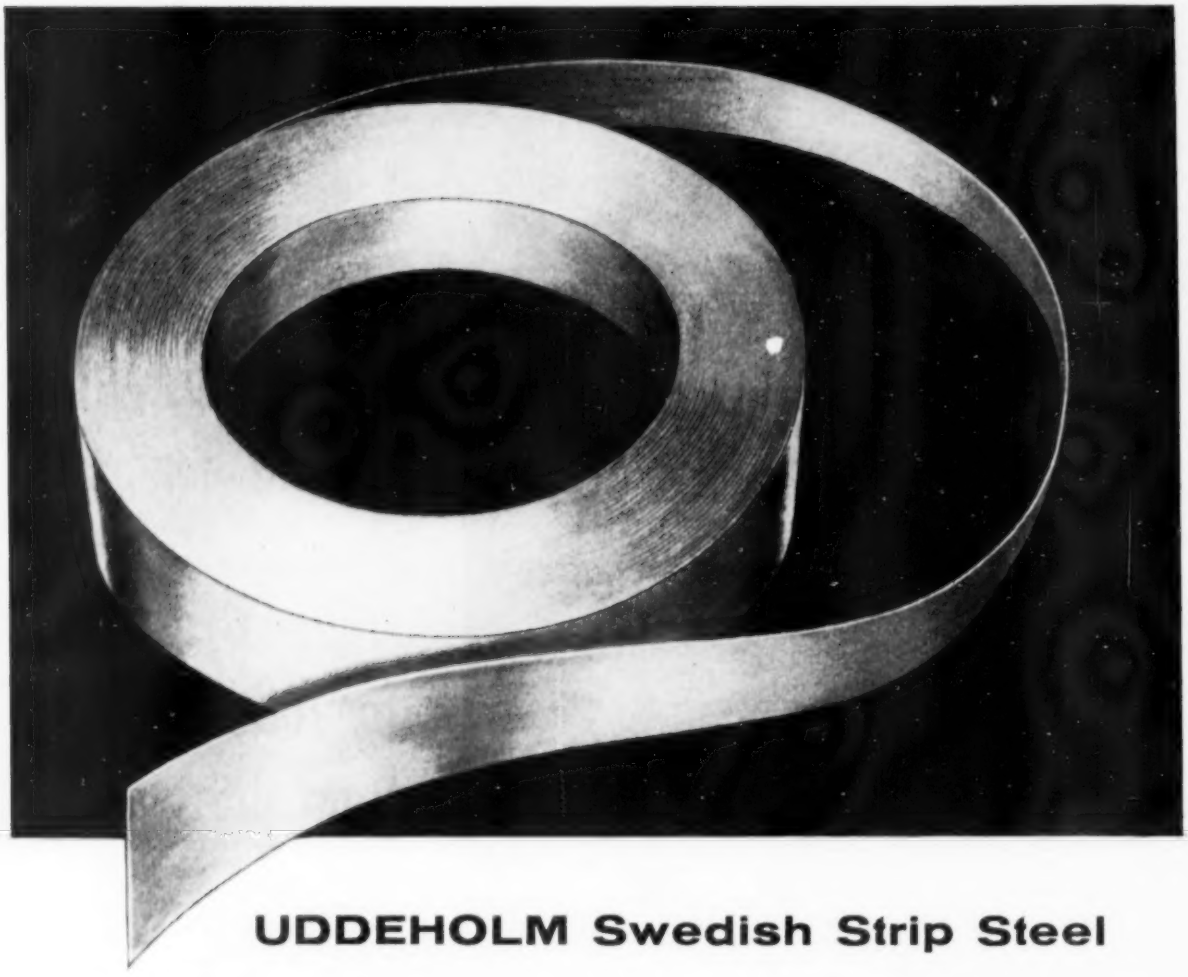
WIDE RANGE—8 Acme-Fette Thread Rolling Heads provide for capacities ranging from 1/16" to 2".

Check where Acme-Fette can help you keep more of your present equipment busy. Send sample or print for our recommendation — or write for your copy of Bulletin NAF-57

ACME-FETTE NEW SERIES "N" HEAD (Size 00)
Rolling No. 6-32 Class 3 Thread on a Single Spindle
Automatic Screw Machine.

National Acme

THE NATIONAL ACME COMPANY
184 EAST 131ST ST., CLEVELAND 8, OHIO
SALES OFFICES: Newark, Chicago, Detroit



UDDEHOLM Swedish Strip Steel

Quality Uddeholm definitely *sells* quality, *extra* quality—and you can expect it. In fact, in the important features of uniformity, flatness, finish, tolerance accuracy, and edge straightness, you'll get even more than you've come to expect.

Performance New customers are consistently surprised, and pleased, with Uddeholm Strip Steel performance—especially when they see it transferred to *their* product. Old customers now take it for granted. It shows up in longer product life, greater fatigue resistance, excellent spring quality, and surfaces free from all defects.

Variety Uddeholm has a wide selection of grades, sizes, tolerances and finishes—in combinations to answer your most exacting needs. Widths range from ⅛″ to 16¾″, thicknesses from .001″ to .125″. Tolerances are possible to ±.00008″. Finishes are bright, scaleless blue, straw polished and blue polished. Slitting and edging facilities are also available.

Large Stocks Abundant supplies are always on hand for almost any application: band saws (metal, wood and butcher), clock springs (flat and coil), intricate machine parts, flapper and flutter valves, Stainless Steel products, shock absorbers, razor blades, feeler gages, reeds, knives, and countless others.

Delivery In a hurry? Say so. Uddeholm is always ready to accommodate "rush" orders.

Write for latest Strip Steel Stock List

UHB

UDDEHOLM COMPANY OF AMERICA, INC.

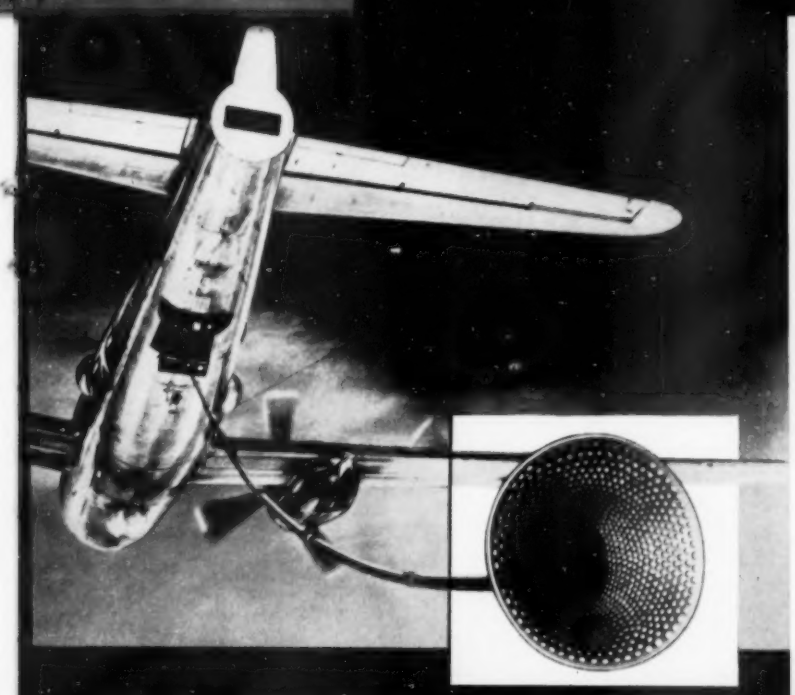
Tool and Die Steels
Specialty Strip Steels

Offices and Warehouses

New York: 155 East 44th Street, MUrray Hill 7-4575
Cleveland: 4540 East 71st Street, DIamond 1-1110
Los Angeles: 5037 Telegraph Road, ANgelus 2-5121

District Representatives:

CHICAGO: Frank J. Mackin, Leroy E. Marshall, 55 East Washington, STate 2-1649 DETROIT: Warren H. Nugent, 17304 Lahser Road, KEnwood 5-6340
PHILADELPHIA: Frank T. Campagna, 34 South 17th Street, RIttenhouse 6-4290



FLYING GAS STATION! Dragues for refueling aircraft in flight show how Araldite Epoxy-glass cloth laminates combine high strength/weight ratios with excellent chemical resistance.
Hampden Brass & Aluminum Co.
Flight Refueling Co., Inc.

ARMOR FOR BOATS! Here an Araldite Epoxy formulation is used with glass cloth for the armor-plating of small boats. The same combination can be used for the rapid, inexpensive repair of splits and gouges in boat hulls.
Cordo Chemical Corporation

from gas stations in the sky... to armor for small boats...

LAMINATING WITH ARALDITE® EPOXIES SPEEDS UP PRODUCTION.

EASILY PROTOTYPED...
LOW COST MOLDS...
FAST CURING!

Is your problem the production of prototypes for design approval? Is it mass production laminates . . . is it custom work? Whatever the problem, Araldite Epoxies may help you.

Their unique combination of extremely low shrinkage (from less than 0.5% to 2%), dimensional stability, rapid curing (in minutes with heat), and excellent adhesion, are providing answers daily to design and production needs.

Molds, too, can be made inexpensively from wood, plaster or metal.

Or if your interests are tooling, electrical, adhesives or coatings, it would pay you to investigate Araldite Epoxies.

Why not now? The coupon is for your convenience.

CIBA

"FIRST IN EPOXIES"

CIBA's Technical Services, including complete and up-to-date Bulletins on the properties and uses of Araldite Epoxy Resins are always available for the solution of your Epoxy problems. For full information, mail coupon or write.

CIBA produces basic resins only, to be formulated for intermediate and end use

CIBA COMPANY INC., Plastics Division
Kimberton, Pennsylvania TE-3

Please send me full information on CIBA Epoxy Resins for

☐ Tooling ☐ Structural Laminates ☐ General
☐ Electrical ☐ Hi-Strength Adhesives ☐ Surface Coatings ☐ Plastic Body Solders

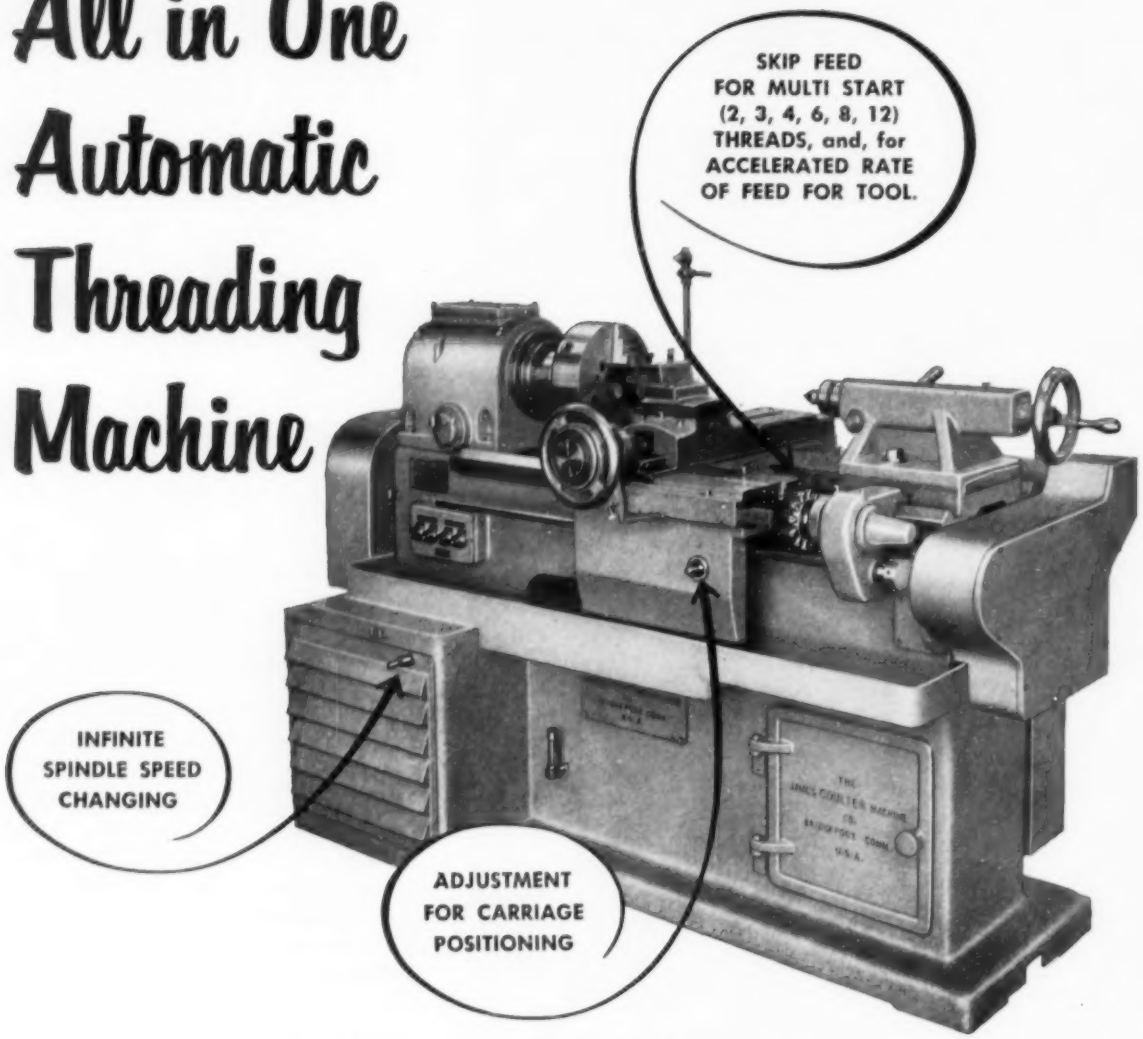
NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ STATE _____

All in One Automatic Threading Machine


SKIP FEED FOR MULTI START (2, 3, 4, 6, 8, 12) THREADS, and, for ACCELERATED RATE OF FEED FOR TOOL.
INFINITE SPINDLE SPEED CHANGING
ADJUSTMENT FOR CARRIAGE POSITIONING

. . . . to insure better, faster, more economical threaded parts

The COULTER High Speed Single Point Model "B" Threading Machine has all the "deluxe" operating improvements found on a combination of several threading machines. Produces precision, high quality threaded parts with more flexibility, more versatility, than any other single point threading machine.

Completely Automatic!

Push button cycle operation all the way... from loading to starting... to resetting to finishing.

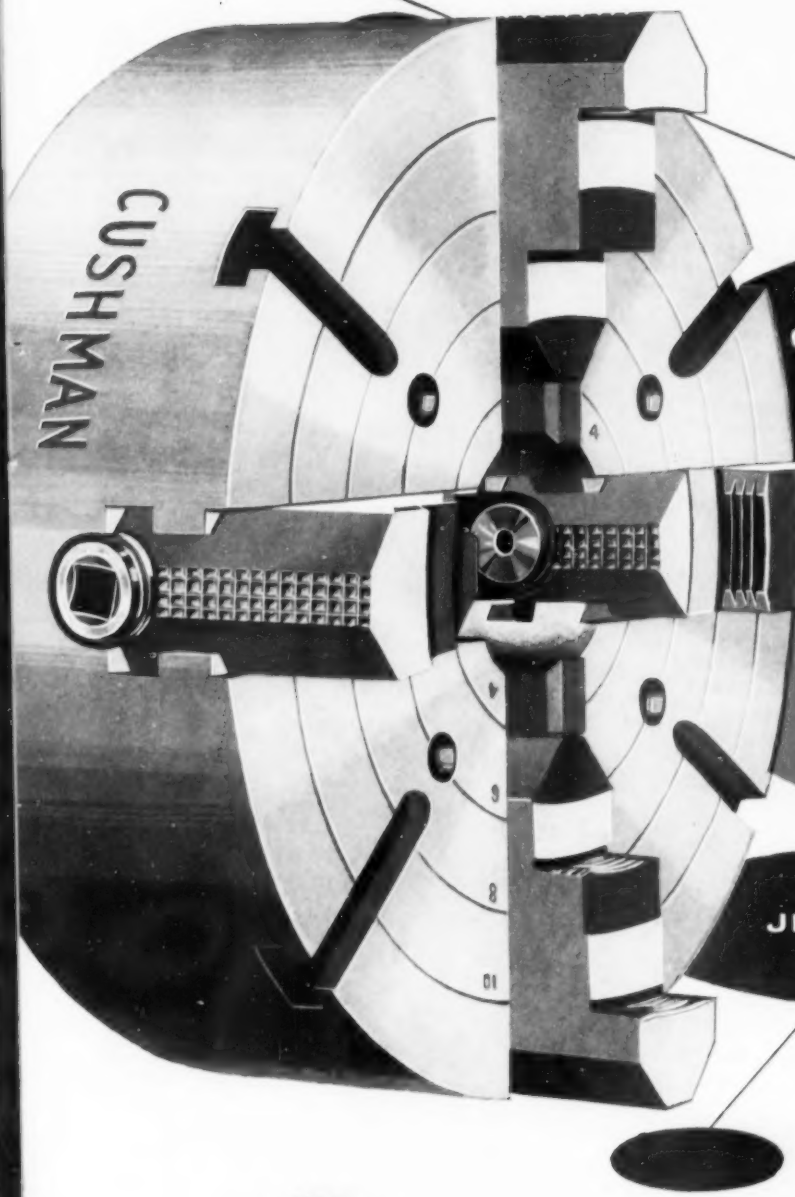
"In and Out" tools control the diameters. "Pick Off" gears change from one pitch to another. These and other COULTER features assure you better threaded parts with lower operating and maintenance costs. It's the greatest possible value for your money!

For the full facts and specifications, write COULTER.

The James Coulter Machine Co. 645 Railroad Ave.
Machine Tool Builders Since 1896
Bridgeport 5, Conn.

CUSHMAN CHUCKS—

the answer to precision workholding



MANUALLY OPERATED CHUCKS
AIR OPERATED CHUCKS and CYLINDERS

POWER WRENCHES
COMPENSATING CHUCKS
ACCRA-SET CHUCKS

JET ENGINE CHUCKS

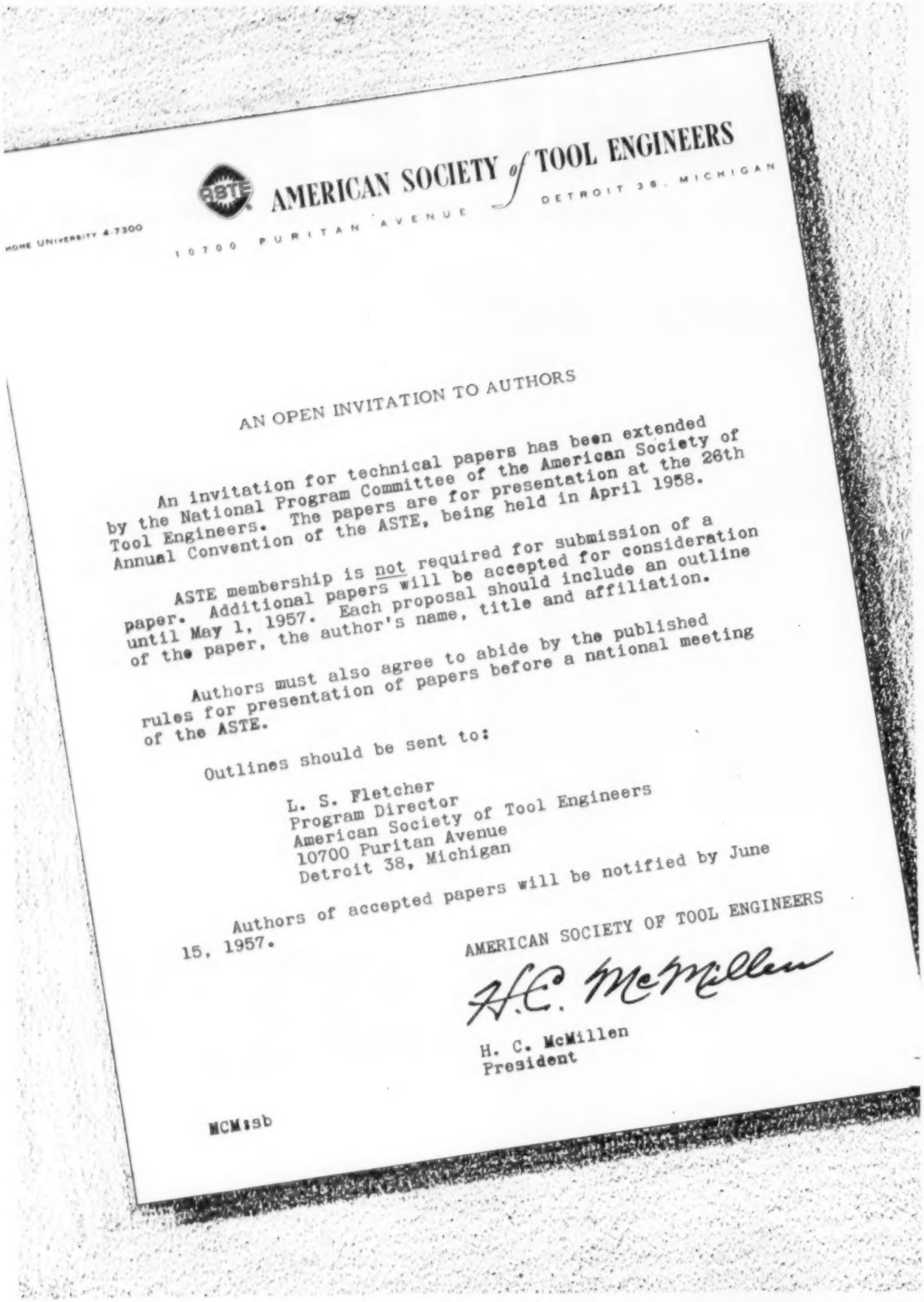
CUSHMAN CHUCKS GIVE CHUCK-ABILITY—
The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right workholding devices.

CUSHMAN the CHUCKMAN CHUCKS AND ACCESSORIES Exclusively SINCE 1867

CUSHMAN CHUCKS . . . a Product of American Quality, Labor and Materials

SOLD THROUGH YOUR INDUSTRIAL DISTRIBUTOR

THE CUSHMAN CHUCK COMPANY • Hartford 2, Connecticut



AMERICAN SOCIETY of TOOL ENGINEERS

10700 PURITAN AVENUE — DETROIT 38, MICHIGAN

HOME UNIVERSITY 4-7300

AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 26th Annual Convention of the ASTE, being held in April 1958.

ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1957. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1957.

AMERICAN SOCIETY OF TOOL ENGINEERS

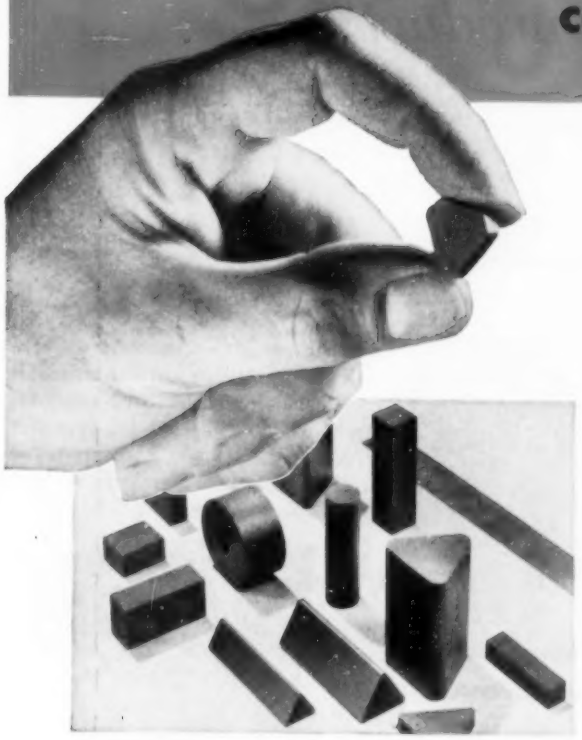
H. C. McMillen

H. C. McMillen
President

MCM:sb

Not once–BUT AGAIN AND AGAIN

production is increased... costs are reduced...



with

STUPALOX
oxide cutting tools

To get the facts, actual field tests were made comparing the performance, machining speed and economy of Stupalox oxide-base metal-cutting tools with previously-used materials. Again and again, Stupalox cutting tools outstripped all others —production was multiplied . . . machining time and costs were slashed.

And that's not all. Performance was outstandingly superior. The extreme hardness and high strength of Stupalox resulted in deeper cuts, smoother finishes and longer tool life. Good results were obtained even with materials previously classified as "unmachinable."

And remember this, *when production goes up and costs go down capital investments in machines and floor space can be reduced.*

CASE HISTORY No. 101

Turning Broach Blanks from 3 1/16" diameter hot-rolled, M-2 H.S.S. Rockwell C-22-26 with Boye & Emmes Engine Lathe.

Results: With Stupalox tool inserts, the total cost of machining was cut from $12.53 to $3.61 per piece.

CASE HISTORY No. 103

Turning O. D. of Bearing Sleeves from Stress-Proof Steel, Rockwell "C" 20-25, using Monarch 18" Engine Lathe.

Results: Using Stupalox, production was boosted and machining cost reduced more than 50%.

CASE HISTORY No. 105

Rough and semi-finish bore 12" cast iron cylinder liner on a LeBlond 24-20 Lathe.

Results: Production per hour was more than doubled, cost per piece was cut from $2.26 to $.92 when Stupalox was used.

STUPAKOFF DIVISION OF

The CARBORUNDUM Co.

WRITE DEPT. TE LATROBE, PENNSYLVANIA

More than thirty years of research and development on special purpose oxides are behind the remarkable success of Stupalox Oxide Cutting Tools—*now available in commercial quantities and in a variety of sizes and shapes.*

For further details on these and other actual case histories mail this request TODAY!

STUPAKOFF Division of
The Carborundum Company, Latrobe, Pennsylvania

Please send copies of the above case histories and other data on Stupalox oxide cutting tools.

Name _____ Title _____

Company _____

Address _____

How much profit is machined out of your product?

Whenever your product is finished one micro-inch more than specified, profit is actually machined away. In the past, this waste was due to the machinist's inability to accurately judge how far he had progressed in his surface finishing operations.

This situation need not exist today. Brush has developed a remarkable new tool, the Brush SURFINDICATOR*, that can be used by anyone to accurately measure surface finish on metal, paper, wood, plastic—*any* material.

The Brush SURFINIDCATOR provides a fast, precision means for checking surface finish right at the machine. Fully portable . . . no special training required.

Here's how profit can be protected

The SURFINDICATOR measures surface finish to within one micro-inch providing a direct reading in accordance with new industrial and military standards. A hand-held stylus is simply stroked over the surface to be measured and the reading taken—no special training is required. The entire SURFINDICATOR is completely portable and permits the machine operator to finish a surface to exact specifications—no more, no less—no wasted machine time, no rejects.

And, to permit accurate re-calibration in the field, precision reference specimens are supplied with every instrument. These specimens, exclusive with Brush, are the ASA approved precision reference standards for surface finish measurement.

SURFINDICATOR booklet contains new ASA standards and complete details on cost-saving finish measurement . . . New Surface Finish Control Efficiency Study can be made on your production line.

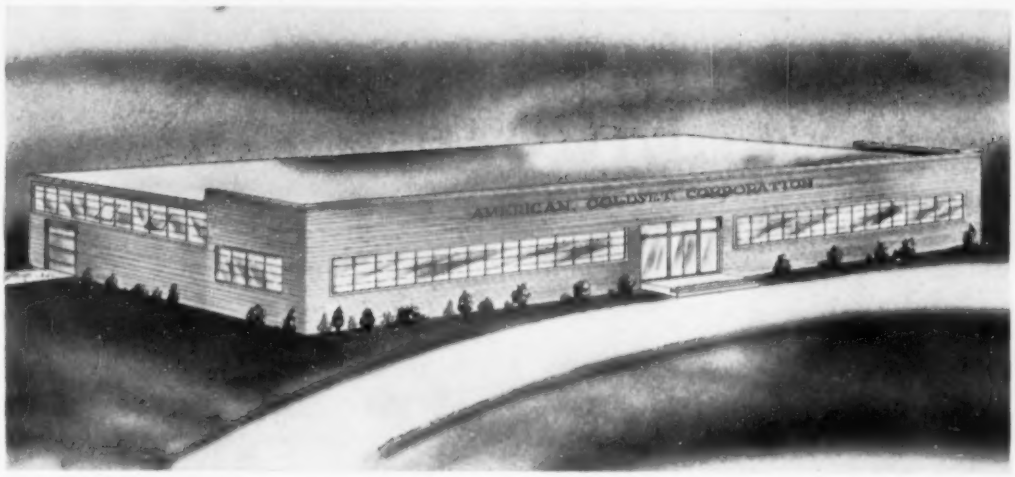
The complete story on how the SURFINDICATOR prevents overfinishing, protects your profits, can be obtained on request. A Surface Finish Control Efficiency Study form is also available to aid in evaluating finishing cost efficiency in your plant. Write for both the SURFINDICATOR booklet and the Efficiency Study form today. *T. M.

BRUSH ELECTRONICS COMPANY

3504 Perkins Avenue, Cleveland 14, Ohio

BRUSH ELECTRONICS

DIVISION OF CLEVITE CORPORATION



the date April 1957

the place Teterboro N. J.

the new home of

American Coldset Corp.

makers of diamond tools,

diamond wheels & core bits!

AMERICAN COLDSET CORP.

For detailed information send for free catalog

COLDSET

carbon-stabilized

PARKER-KALON stress relieved socket screws

All P-K® Socket Screws are hardened in a propane atmosphere in this Westinghouse furnace to prevent carbon loss, eliminate adsorption of foreign gases. Part of P-K's controlled processing which assures consistent high quality, prevents precipitation or crystallization. Another good reason why . . . *If it's P-K . . . It's O-K!*

PARKER-KALON DIVISION, General American Transportation Corporation • Manufacturers of Socket Screws, Self-tapping Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws.

Sold Everywhere Through Leading Industrial Distributors — Factory: Clifton, New Jersey • Warehouses: Chicago, Illinois; Los Angeles, California

PARKER-KALON® fasteners

ACCURACY WITHIN 5 THOUSANDTHS OF AN INCH . . . OVER 14,400 SQUARE INCHES!

An example of a precision surface need met by CHALLENGE EQUIPMENT.

The American Seating Company of Grand Rapids, Michigan, needed a precision surface 50 feet in length, accurate within 5 thousandths of an inch over the entire area, on which to inspect the aircraft wing spars and aluminum castings they are producing for a large aircraft manufacturer.

The answer was easy! Challenge supplied five of their standard Sectional Assembly Layout Surface Plates each 10 feet in length. When keyed and bolted together, these "exclusive" Challenge units, each accurate within .002", provide an overall accuracy of .005 of an inch. Another advantage for American Seating is the flexibility of these units! If the production needs change, the sections can be taken apart and used separately, or new sections can be added as needed.

This is just one example of how Challenge has helped many manufacturers solve their precision surface requirements. Challenge has the broadest line of precision surface equipment and Challenge factory specialists are available to work with you on your needs. So, if you have an inspection, assembly or manufacturing problem involving precision surfaces, **check first with Challenge.**

Write Challenge, for a complete Catalog of Challenge Standard Precision Surface Equipment — including Semi-Steel and Granite Surface Plates, Semi-Steel V-Blocks, Angle Plates, Floor Plates, etc. . . .

Available through local mill supply distributors.

SE-107

Challenge®

TE-3

THE CHALLENGE MACHINERY COMPANY
GRAND HAVEN, MICHIGAN

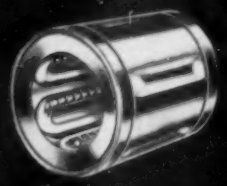
Please send me your free catalog — 838W of Challenge Precision Surface Equipment.

Name _____ Position _____
Company _____
Address _____
City _____ State _____

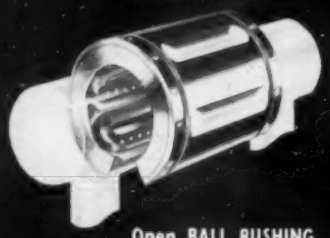
NOW! *Adjustable Diameter and Open*

THOMSON BALL BUSHINGS

Adjustable Diameter BALL BUSHING for Zero Clearance



Precision Series "A" and
Low Cost Series "B" BALL BUSHING



Open BALL BUSHING
for Zero Clearance on
Supported Shafts

LOW FRICTION · ZERO SHAKE OR PLAY
ELIMINATE BINDING AND CHATTER
SOLVE SLIDING LUBRICATION PROBLEMS
LONG LIFE · LASTING ALIGNMENT

Also manufacturers of NYLINED Bearings . . . Sleeve Bearings of DuPont NYLON

The BALL Bearing for *all* your

LINEAR MOTIONS

Sliding linear motions are nearly always troublesome. Thousands of progressive engineers and designers have solved this problem by application of BALL BUSHINGS on *guide rods, reciprocating shafts, push-pull actions,* or for support of *any mechanism that is moved or shifted in a straight line.*

Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

The various types cover a shaft diameter range of ¼" to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

THOMSON INDUSTRIES, Inc.

Dept. A, MANHASSET, NEW YORK

PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS–A MAJOR IMPROVEMENT AT A MINOR COST

If you stay abreast of Scully-Jones engineering, you stay ahead of competition

29 new tools and improvements in the last five years . . . ask your Scully-Jones representative which of these can help you save money

Here is a pictorial progress report from Scully-Jones to the tool engineers in profit-minded plants . . . engineers searching for new ways to beat competition and get more out of their machine tools, skilled labor, and cutting tools. Many of the 29 developments represented above are improvements in so-called "standard tools," such as drill and tap chucks, milling machine arbors, and floating holders—each an example of how Scully-Jones creative engineering breaks through "standpat" methods of tool holding and driving.

Add to these advances improvements in Scully-Jones manufacturing techniques that give you *premium quality*: more accurate threads . . . better grain structure . . . hardened and ground surfaces where you need them . . . plus all the other details adding up to completely finished *precision* holding tools. These are the reasons Scully-Jones tools pay off in increased accuracy, reduced downtime, faster setup, increased production, and simpler operations, for drilling, tapping, reaming, milling, recessing, tool control, inspection, and assembly. By working closely with your Scully-Jones representative or distributor, you keep up to date with production advances, stay ahead of competition.

25th ANNIVERSARY 1932 1957

A BETTER LIFE THROUGH CREATIVE MANUFACTURING

SCULLY JONES

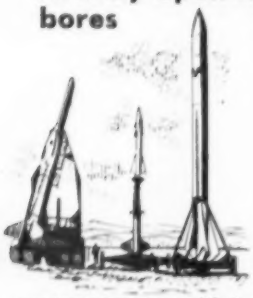
PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

SCULLY-JONES AND COMPANY, 1915 SOUTH ROCKWELL ST., CHICAGO 8, ILL.

Did you know that – – –

Jet Propulsion Equipment relies heavily upon this gage for critical bores



Precision Internal Gage
SIZES FROM
1/8" to 10"
AND LARGER

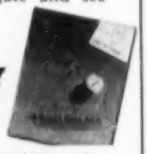
COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from ⅛" to 10" dia.

UNIQUE ADVANTAGES

- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed — not passing — reading.
- Positive 2-point gaging — automatic centering.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Will gage work in the machine.
- A shop tool for all-day every day use.
- Portable — no wires, hoses, stands or electronic gear.

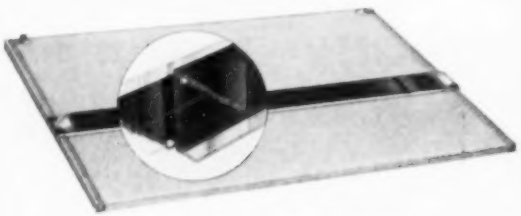
Investigate the gage used by the thousands in jet engine, guided missile, farm and road machinery, automotive transmission, household appliance and other volume-precision plants. IT MAKES PRECISION EASY . . . at machines . . . at inspection bench . . . for selective assembly. No other like it — investigate and see why.

COMTOR COMPANY
69 Farwell St.
WALTHAM 54
MASS.



GET THE FACTS — REQUEST BULLETIN 50
USE READER SERVICE CARD; INDICATE A-3-440-1

MAYLINE



The *Mayline* Mobile

Finest Straightedge of them all!

A straightedge that moves easily and readily, yet hugs the paper at the slightest pressure. Keeps drawings cleaner. Blade is of phenolic laminate, edges are crystal clear butyrate.

When used with the Mayline counterbalance straightedge will hold position, even at the vertical angle. Other Mayline straightedges are: Regal, Ideal, and E-Z Grip. Available in lengths from 30" thru 96". Ask your dealer for complete information about the Mobile.

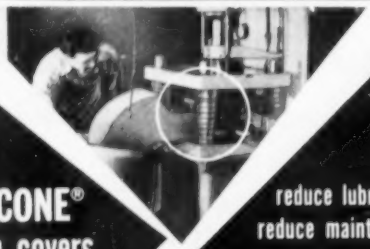
MAYLINE COMPANY INC.
611 No. Commerce St., Sheboygan, Wisconsin

MAYLINE

MAYLINE

MAYLINE
USE READER SERVICE CARD; INDICATE A-3-440-3

new ELASTICONE® guide pin covers CUT DIE COSTS 25%



reduce lubrication
reduce maintenance
increase press time
preserve alignment

Discover how inexpensive ELASTICONES can provide increased production, lower die costs by closing the gaps between pins and bushings, reducing die breakage and maintenance. Just snaps into place — no installation or maintenance costs! Bulletin 53 contains complete information. Send for it today!

CENTRAL *Safety Equipment Co.*
6615 MARSDEN ST. PHILADELPHIA 35, PA.

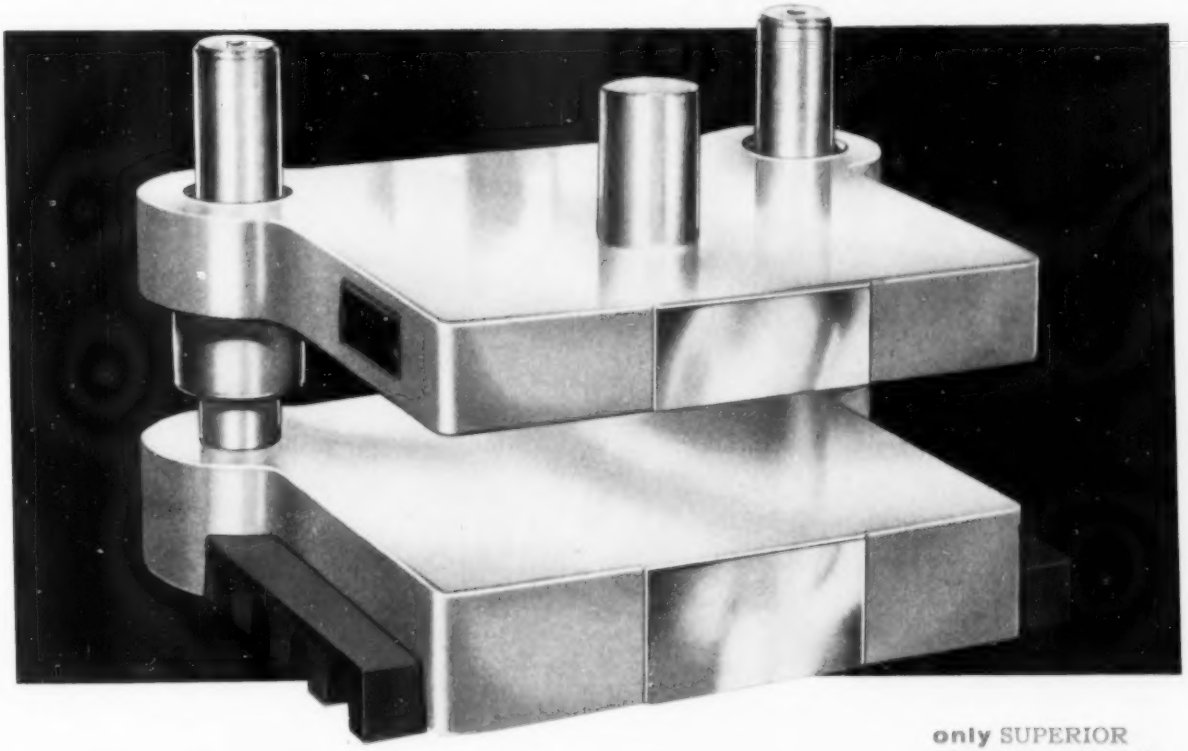
For complete information on Elasticones and a copy of Bulletin 53 use convenient coupon.

Name_____ Title_____
Firm Name_____
Address_____
City_____ Zone____ State_____
TE-3

USE READER SERVICE CARD; INDICATE A-3-440-2

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 233.

handle large and small die sets...



SAFER, FASTER MORE EFFICIENTLY

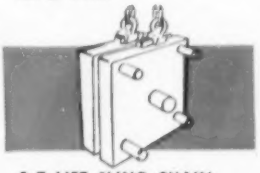
Large Sets No Longer Need Be Blocked . . .
Small Sets Can Be Lifted Without Sliding.

Features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment.

only SUPERIOR gives you these exclusive features

SAFETY FLANGE
protects fingers by providing roomy gripping space on either side of the die shoe.

LOCK-JAW LIFTING DEVICE
removes the danger of handling large die sets. Positioned to insure proper balance when the set is lifted by either chain fall or crane.



E-Z LIFT SLING CHAIN
is especially designed to fit the flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting.

For Fast Local Service Call These Superior Representatives

Kalamazoo, Mich. Fireside 5-7588
Indianapolis, Ind. Clifford 5-5668
Rockford, Ill. 3-3931
Dayton, Ohio Hemlock 6209
Chicago, Ill. Randolph 6-8871
St. Louis, Mo. Jef 5-1223
Dallas, Texas Riverside 5138
Winter Park, Fla. 4-0464
Minneapolis, Minn. FR 1-1321
Memphis, Tenn. 33-7727
East Orange, N. J. Orange 5-5810
Denver, Colo. Enterprise 234
Agawan, Mass. Republic 9-1132
Madison, N. J. Frontier 7-0407
Schenectady, N. Y. Franklin 2-4381
North Haven, Conn. Cedar 9-1661
Racine, Wis. Melrose 2-1900

Plants at

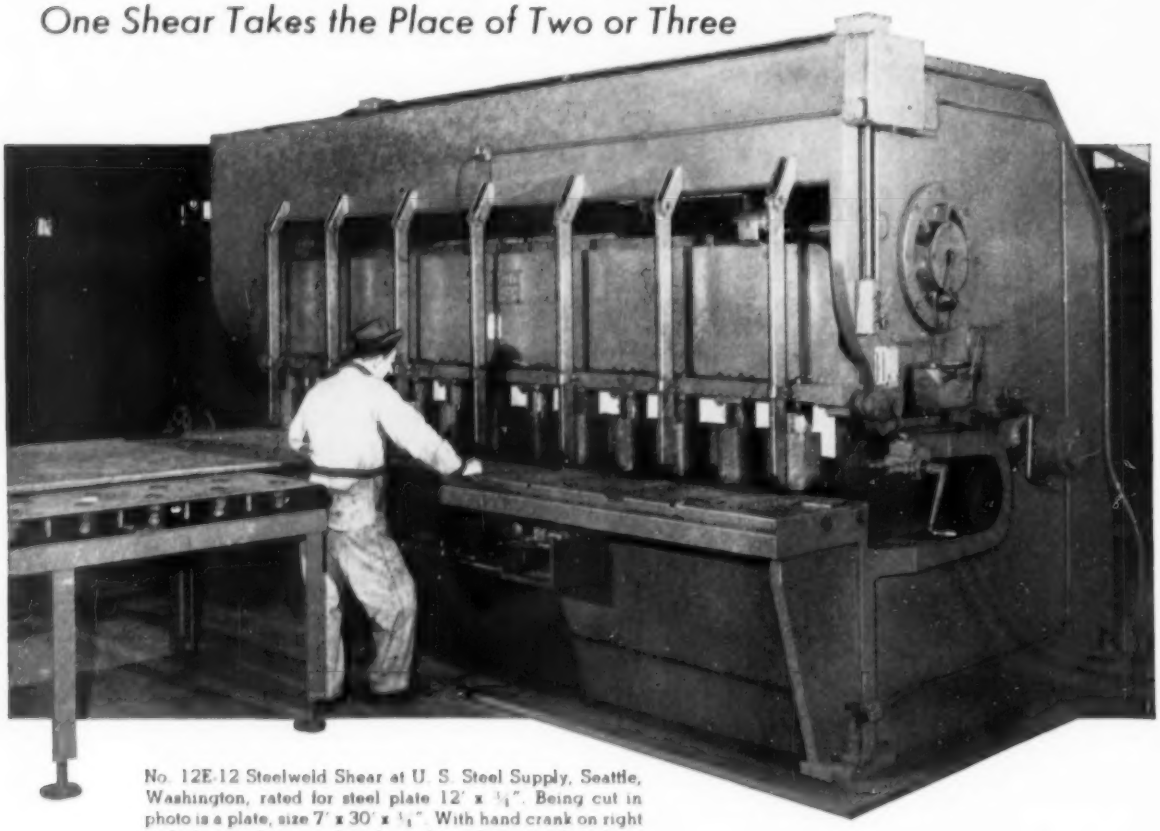
Milwaukee, Wis. Mitchell 5-6027
Plainville, Conn. Sherwood 7-2761

Write for FREE 24 page Catalog on Superior Die Sets and Supplies

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

U. S. Steel Supply Provides Customers with **SMOOTH ACCURATE SHEARING**

One Shear Takes the Place of Two or Three



No. 12E-12 Steelweld Shear at U. S. Steel Supply, Seattle, Washington, rated for steel plate 12′ x ¼″. Being cut in photo is a plate, size 7′ x 30′ x ¼″. With hand crank on right end, this machine can be adjusted in a few seconds to have exactly the right knife clearance to obtain the finest cut for any thickness. To make this adjustment on guillotine-type shears usually requires several hours.

MANY steel warehouses have two and often three shears, one of a ¼″ capacity for lighter thicknesses, another of ½″ capacity for cutting ¼″ to ½″ material, and a third with 1″ capacity for thicknesses over ½″ and up to 1″. At some of its warehouses, U. S. Steel Supply uses only one machine for cutting the various thicknesses—a Steelweld Pivoted-Blade Shear.

One machine takes the place of two or three, because it is so easy to adjust the knife clearance required to obtain the best cuts for different thicknesses, which can range from lightest gauge metal to the heaviest plate within the capacity of the shear.

Thus, the investment in shearing equipment is kept low, yet the customers of U. S. Steel Supply are always assured of straight, smooth, accurately cut metal on every order.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

8553 East 282nd Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

Write for your copy Today

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

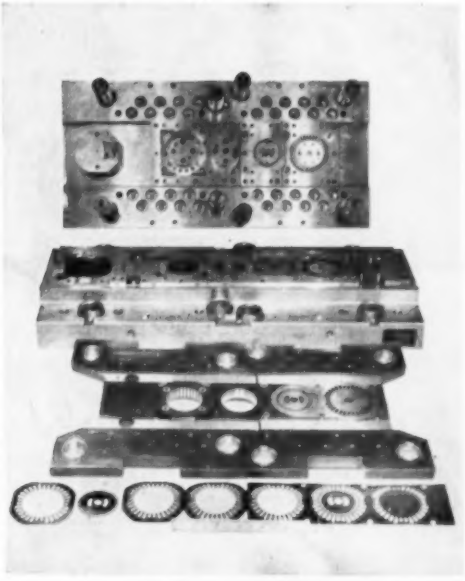
46" LAMINATION DIE BUILT BY COMMANDO TOOL

High carbon high chrome

Commando has built the largest and smallest carbide or steel dies that can be built in the lamination field.

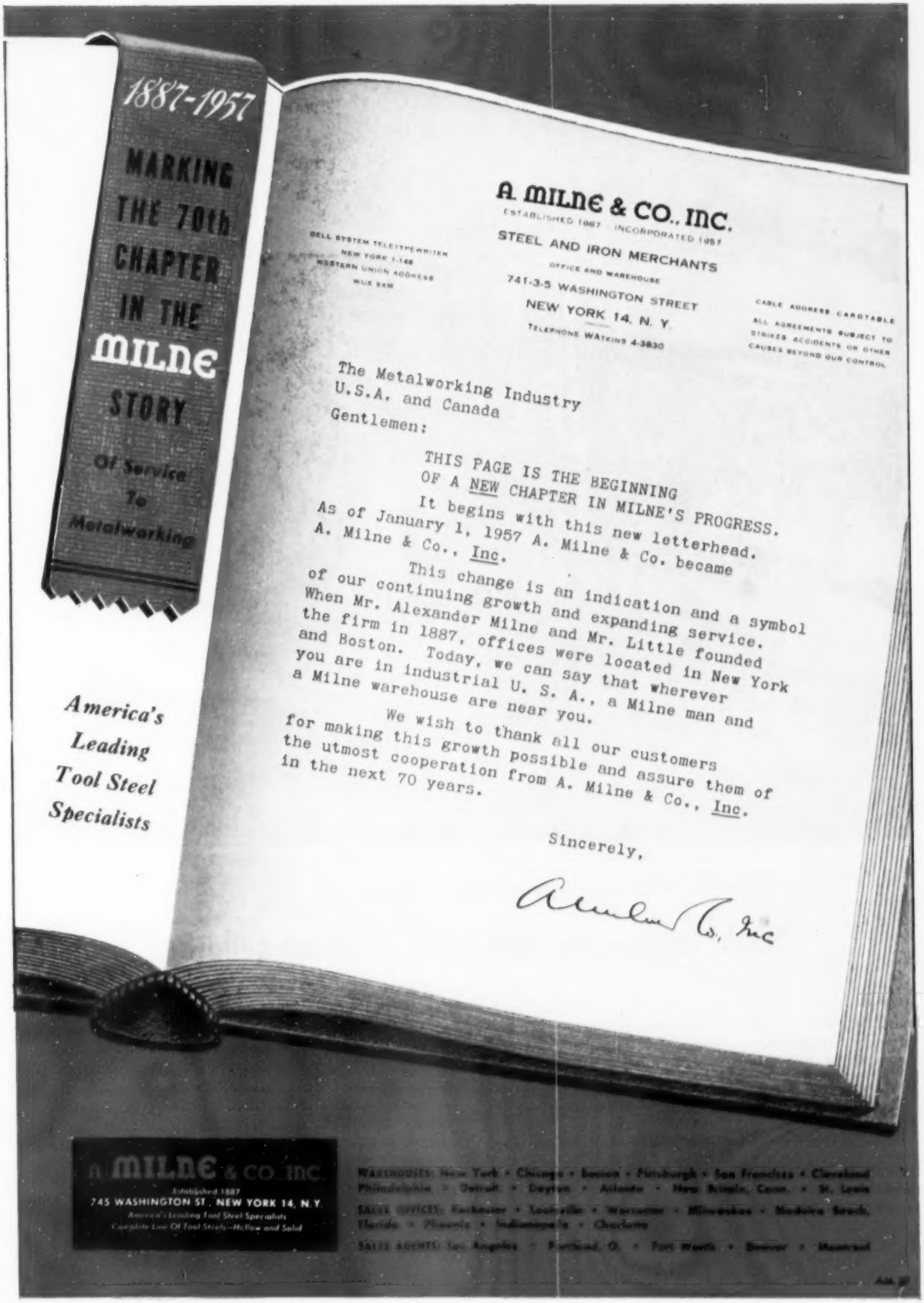
These dies built of both tungsten carbide or high carbon, high chrome steel range from approximately 5/16" to 46". The die illustrated at the left is one of the largest rotor lamination dies ever built. It is 46" in diameter.

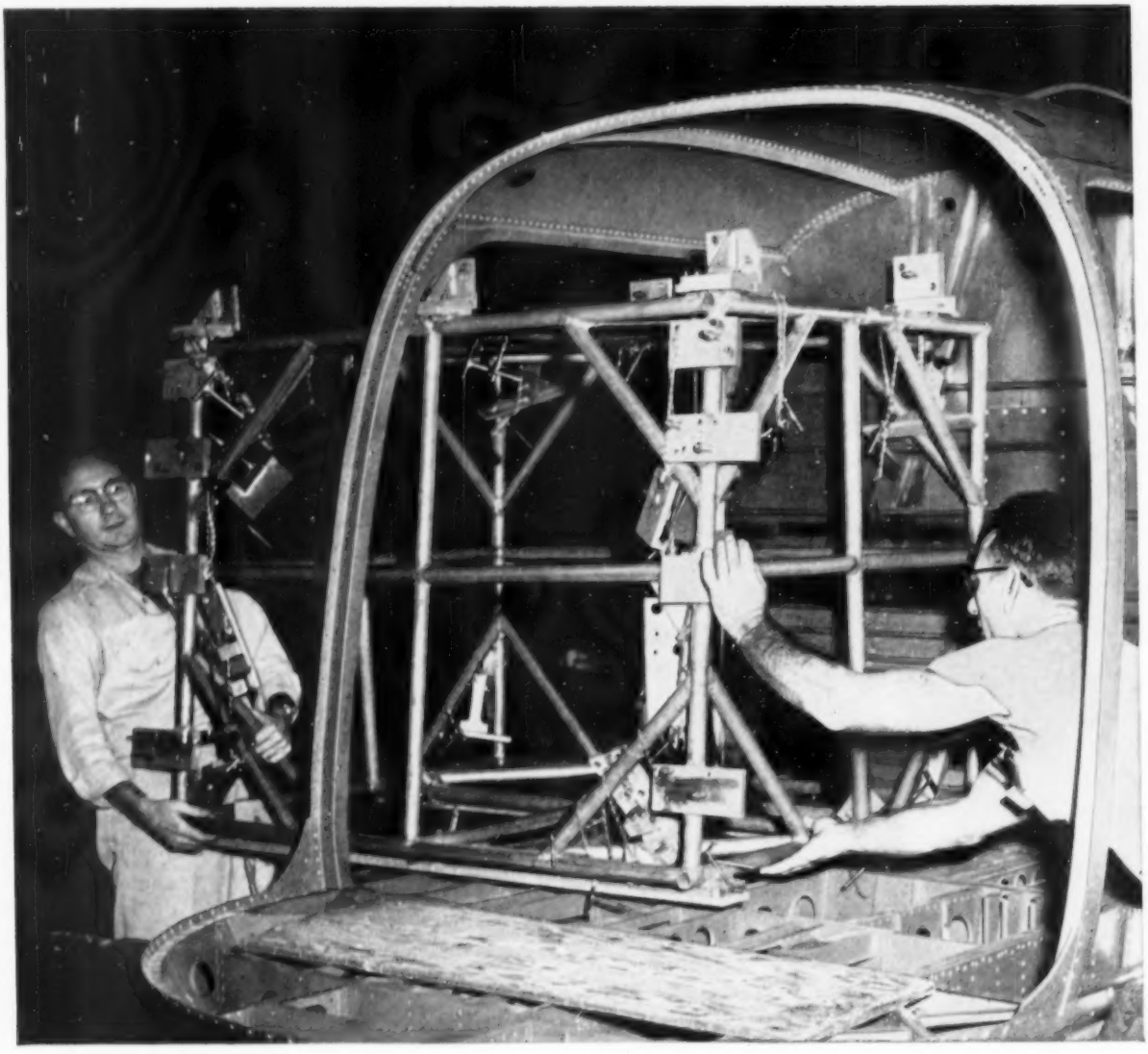
The dies shown have required thought and ingenuity by our engineering department. All we require from our customers is a part print from which we can issue a quotation. When awarded the job we can design, produce and deliver the finest products in the lamination die field.



Progressive Carbide

COMMANDO TOOL INC. P. O. Box 90 21723 Republic Detroit 20, Michigan


1887-1957
MARKING THE 70th CHAPTER IN THE MILNE STORY
Of Service To Metalworking
America's Leading Tool Steel Specialists
A. MILNE & CO., INC.
ESTABLISHED 1887 INCORPORATED 1957
BELL SYSTEM TELETYPEWRITER NEW YORK 1-140
WESTERN UNION ADDRESS WUX 5XM
STEEL AND IRON MERCHANTS
OFFICE AND WAREHOUSE
741-3-5 WASHINGTON STREET
NEW YORK 14, N. Y.
TELEPHONE WATKINS 4-3830
CABLE ADDRESS CARDTABLE
ALL AGREEMENTS SUBJECT TO STRIKES ACCIDENTS OR OTHER CAUSES BEYOND OUR CONTROL
The Metalworking Industry
U.S.A. and Canada
Gentlemen:
THIS PAGE IS THE BEGINNING
OF A NEW CHAPTER IN MILNE'S PROGRESS.
It begins with this new letterhead.
As of January 1, 1957 A. Milne & Co. became
A. Milne & Co., Inc.
This change is an indication and a symbol
of our continuing growth and expanding service.
When Mr. Alexander Milne and Mr. Little founded
the firm in 1887, offices were located in New York
and Boston. Today, we can say that wherever
you are in industrial U. S. A., a Milne man and
a Milne warehouse are near you.
We wish to thank all our customers
for making this growth possible and assure them of
the utmost cooperation from A. Milne & Co., Inc.
in the next 70 years.
Sincerely,
A. MILNE & CO. INC.
Established 1887
745 WASHINGTON ST., NEW YORK 14, N.Y.
America's Leading Tool Steel Specialists
Complete Line Of Tool Steels—Hollow and Solid
WAREHOUSES: New York • Chicago • Boston • Pittsburgh • San Francisco • Cleveland
Philadelphia • Detroit • Dayton • Atlanta • New Britain, Conn. • St. Louis
SALES OFFICES: Rochester • Louisville • Worcester • Milwaukee • Madeira Beach, Florida • Phoenix • Indianapolis • Charlotte
SALES AGENTS: Los Angeles • Portland, O. • Fort Worth • Denver • Montreal



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

"Light magnesium tool helps precision-build Bell 'copters"

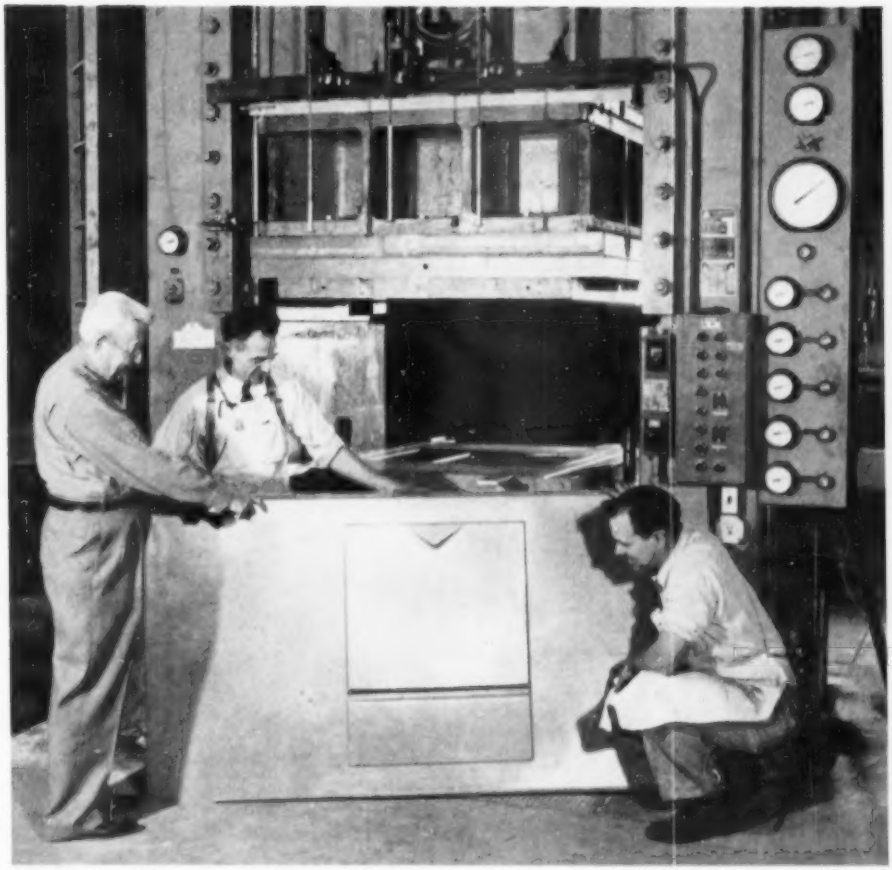
"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415U-1.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW



Hotpoint cuts weeks on model change with press dies of DEVCON THE PLASTIC STEEL

Trade Mark

Hotpoint wanted to produce sheet metal panels for its new pilot model . . . without waiting costly weeks for regular steel dies.

Starting from scratch, it took just five days to start manufacturing panels with the DEVCON tooling. Later, the tool steel dies were substituted, replacing the temporary dies. But, the presses had been running . . . getting out production parts in time to meet marketing schedules.

This is just a single instance where DEVCON, THE PLASTIC STEEL — (80% steel — 20% plastic) has saved a company weeks of waiting and countless dollars. DEVCON handles like modeling clay . . . hardens to a steel-like mass in two hours . . . produces intricate tools, jigs, fixtures, molds and dies. It can be sawed, drilled, tapped or ground with conventional metal working tools. DEVCON makes a precision form of original forms or patterns, without shrinkage or distortion.

DEVCON has 1001 other uses too . . . saves money in repairing and rebuilding machinery, tanks and equipment . . . large or small holes in castings can be filled . . . worn pumps and valves can be built up for longer life. Bonds to itself, steel, iron, aluminum, brass, bronze, wood, porcelain and many other materials.

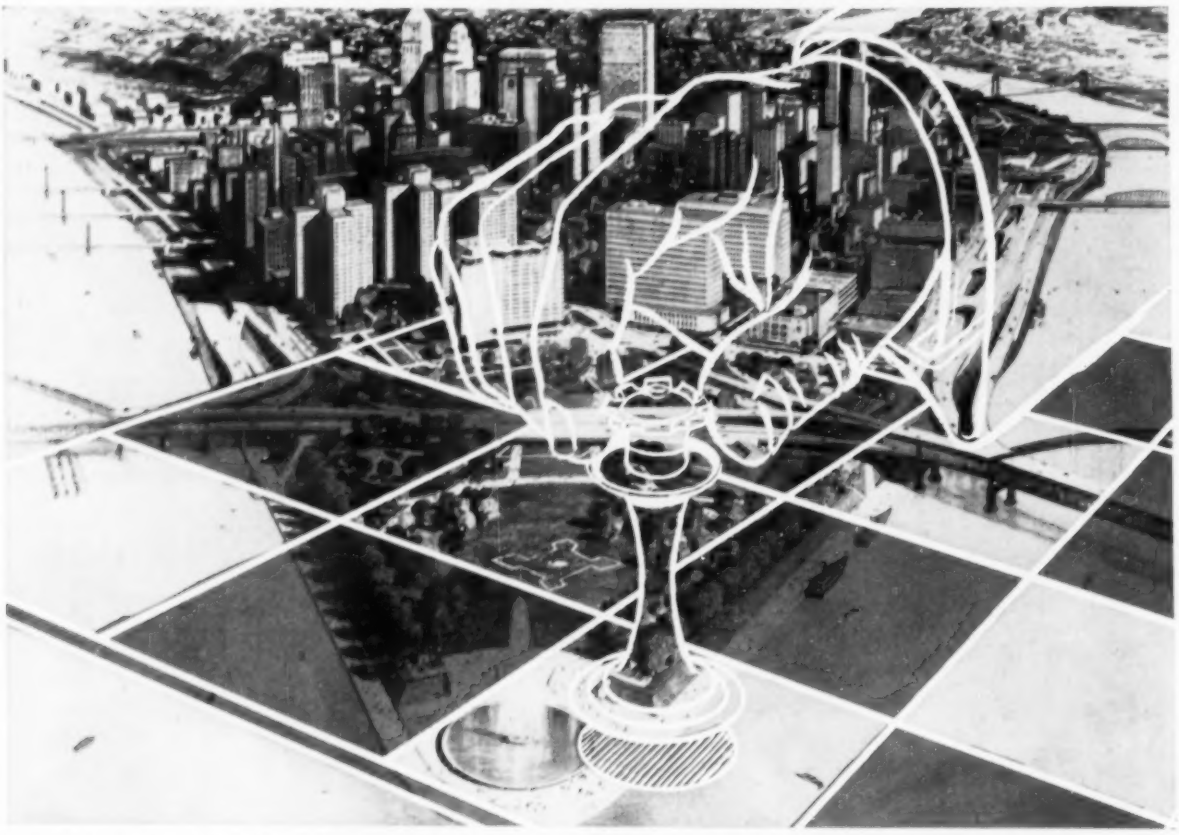
Write today for 8-page brochure showing how DEVCON — THE PLASTIC STEEL (available in four types) can save countless hours and dollars in *your* plant.

TECHNICAL REPRESENTATIVES IN ALL MAJOR CITIES

Distributed by leading industrial suppliers

DEVCON CORPORATION

129 ENDICOTT STREET, DANVERS, MASS.



Smart Move – Smart Engineer

An exciting career with WESTINGHOUSE
—First in Atomic Power . . .
A wonderful way of life in PITTSBURGH
—Renaissance City of America

It's the wise engineer who is making the move to WESTINGHOUSE—PITTSBURGH. Not only is he contributing his talents to the important task of building America's ATOMIC FLEET, but he is experiencing the wonders of living in the NEW Pittsburgh. No city in the United States has undergone the metamorphosis of this great metropolis; and the extraordinary results are evident everywhere—from the new, safe, wide highways to the delightful tree-lined, residential communities. For a way of life that is truly fit for a "king", the smart move is to PITTSBURGH, and an ATOMIC POWER career with WESTINGHOUSE.

Send your resume to: Mr. John D. Batey, Dept. #M-17
Westinghouse Electric Corporation
P. O. Box 1047, Pittsburgh 30, Penna.

Responsible positions that offer immediate opportunities. NO DELAYS AWAITING SECURITY CLEARANCE.

ELECTRICAL ENGINEERS
Degree; design, application, test and analysis of instrumentation and control systems and components.

MECHANICAL ENGINEERS
For liaison. Power Plant machinery layout. Some stress, supervise final installation. Degree required.

HEAT EXCHANGER ENGINEERS
Mechanical engineers for design and manufacturing follow of heat exchangers and steam generators for high pressure service. Degree required.

MANUFACTURING ENGINEERS
Experienced pumps, valves. Work as liaison between engineering department and venders on centrifugal pumps and other semi-standard centrifugal and positive placement pumps and valves.

METALLURGICAL ENGINEERS
Responsible for materials and processes application to marine nuclear power plants.

Westinghouse
ELECTRIC CORP.

Schrader PILOT VALVES like the one above, and the one indicated by the red arrow, are used for remote control of air systems. Here, three are used to control the dip hopper air system. Schrader makes hundreds of air products to fit the needs of any operation. A few are indicated by red numbers, 1 through 7.

How Schrader Air Products help give

3 baths to plated parts—automatically!

Dipping baskets of plated parts in three successive baths was a monotonous, slow job at this plating company in New Haven, Connecticut. Then the operation was automated with Schrader Air Products. The dip hoppers now operate as if by magic—alone. Completion of one sequence automatically starts another. Just one more example of air at work in industry.

There is no limit to what air can do, except man's own imagination. Every day new operations are being performed with air. Its economy, efficiency and safety make it a natural for the world of tomorrow.

But *you* can get started today. Schrader engineering facilities are available upon request, to assist you in planning for the best use of air in your plant. Send for the latest informative booklets which show Schrader Air Products that can help you produce more economically.

Schrader®
ESTABLISHED IN 1844

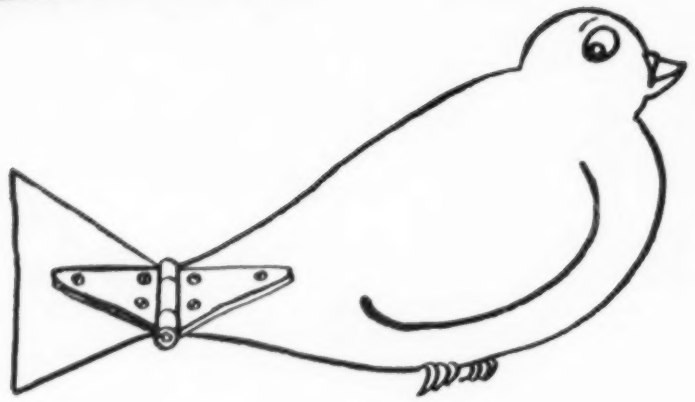
A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-449

DROODLES

by ROGER PRICE



Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"DOVETAIL JOINT"

Several years ago, when I first made my mark as a demon bird-watcher, I had a nice little organization going in the upper Bronx, known as "The Feathered Friends". My pal, Speedy Bledsoe, was Pres., I was Treas., and we had 47 dues-paying members. When we split up the city for watching assignments, Speedy and I took 3rd Avenue, near Wally's Place, where he and I held our Executive Sessions. Some of our dopey club members got all churned up when they found out. At the next meeting, they voted a bonus for me and Speedy, consisting of a bucket of hot tar each. Needless to say, they threw in some feathers for good measure.

Speaking of good measure reminds me of the Jones & Lamson Optical Comparator. This is a precisely engineered instrument that is used throughout industry for measuring and inspecting all sorts of parts and objects of various sizes and shapes. It is speedy and accurate (to .0001") and reduces inspection costs to a minimum. The J & L Comparator is extremely versatile, making it equally suitable for both production-line and job-shop work. You'll find it enables you to perform inspections that just aren't possible by any other method. Get the full details . . . point a carrier pigeon Vermont-ward and send this coupon *today!*

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

Involute forms, analyzed for Production Control

J & L's new method not only inspects but also analyzes the form, position, spacing and other aspects of involute gears and splines. This system provides the necessary information for correction or adjustment in the manufacturing process by which these involute forms are generated. *A single master chart covers a wide range of sizes.* WRITE FOR OUR ENGINEERING STUDY, "OPTICAL ANALYSIS OF GEARS AND SPLINES".

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 518 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____

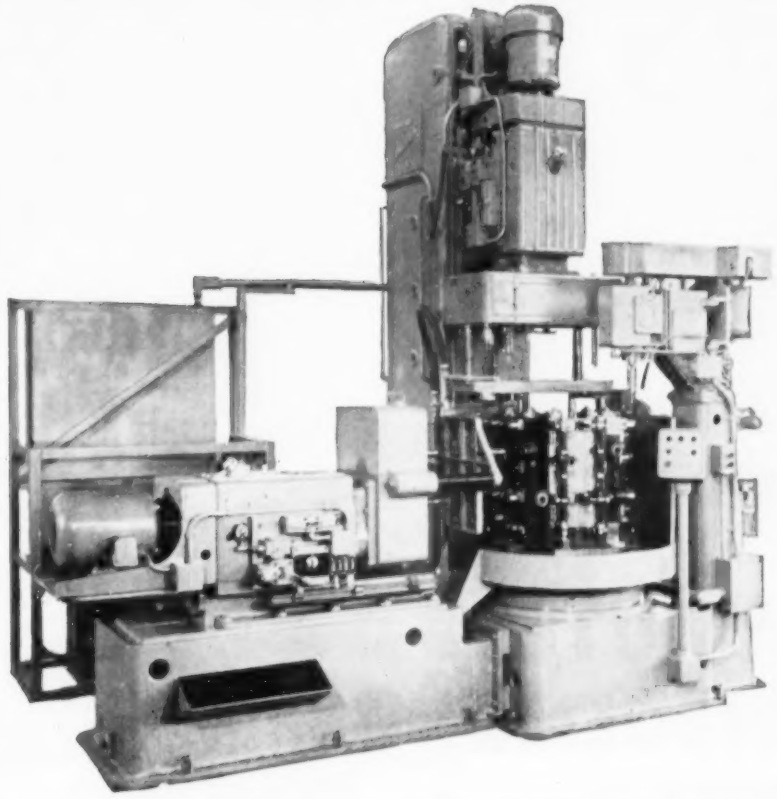
company _____

street _____

city _____ zone _____ state _____

Another Special by

STANDARD-MODERN



FEATURES

- Economy of construction
- Rigid strength
- Correct drill speeds
- Accurate hole location
- Infinitely variable feed rates
- Completely automatic cycle
- Double work-holding fixtures
- Automatic lubrication

This Special Purpose Machine **DRILLS, REAMS and TAPS**
131 Automotive Cam Shafts per hour at 80% efficiency.

Developed by Standard-Modern, this high production Special Purpose machine drills, reams and taps oil holes in cam shafts at the rate of 26.4 seconds each.

Two cam shafts at a time are loaded vertically into rigid work-locating fixtures, where they are held by clips until manually clamped into accurate position. Pressing the cycle start button indexes the machine through its four work stations where hydraulic drilling, reaming and tapping units advance and feed to depth.

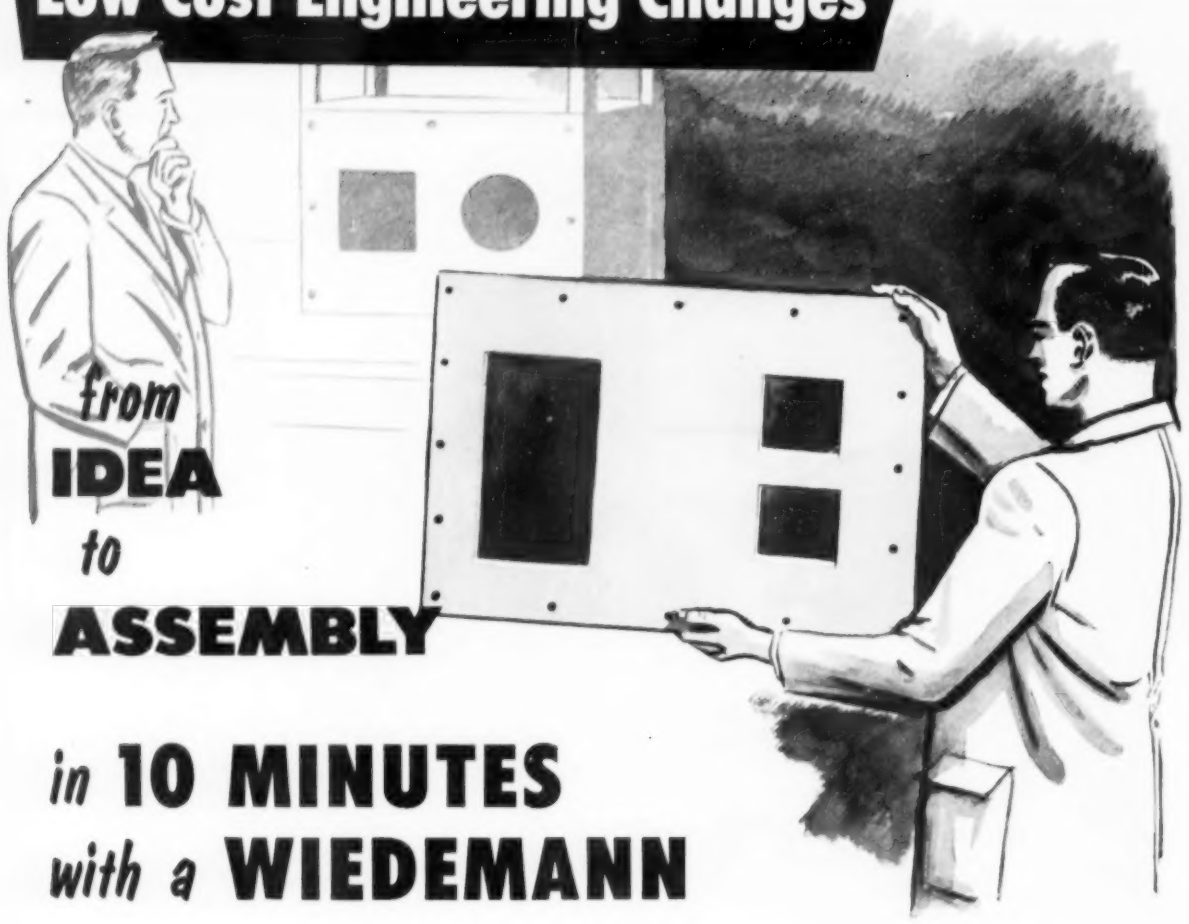
Loading and unloading is done at the first station while drilling, reaming and tapping operations are performed.

STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.

STANDARD-MODERN
TOOL COMPANY LIMITED
MANUFACTURING DIVISION
69 Montcalm Avenue, Toronto, Canada • 3030 Walker Road, Windsor, Canada

SP-5

Low Cost Engineering Changes

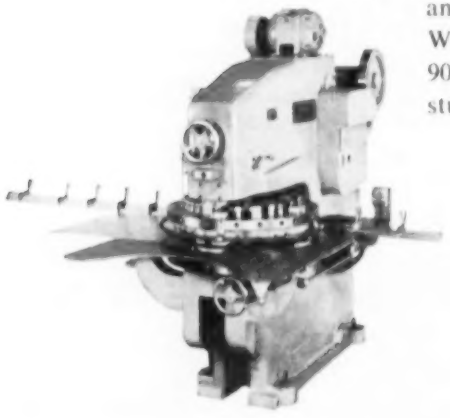


from IDEA to ASSEMBLY

in 10 MINUTES with a WIEDEMANN

When the job on the left was assembled, the need for engineering changes in the mounting plate was evident. Greater rigidity was required. Openings were of wrong size and incorrectly placed. Hours of valuable production time could have been lost—but, using a Wiedemann Turret Punch Press, the new part was ready for assembly in less than 10 minutes after the change was ordered.

Whether simple or complex, on-the-spot engineering changes can be made at amazingly low cost. This is just one of the many ways the Wiedemann Method cuts short run piercing costs 60% to 90%. Want proof? Send drawings of your work for a time study and write for Bulletin 201.



There's a Wiedemann for every short run piercing requirement.

WIEDEMANN MACHINE COMPANY

4245 Wissahickon Ave. • Philadelphia 32, Pa.

memo

Epoxy Users
U. S. A.

March 25, 1957

* If you have a dermatitis problem, we invite you to try our SAFETY HARDENERS with EPOCAST Tooling Plastics. These hardeners have been specifically synthesized by Furane Plastics Inc. for use with EPOCAST Tooling Plastics. Furthermore, they make possible superior quality control in plastics tooling.

FURANE PLASTICS INC.
Rex D Brookhart
Rex D. Brookhart
Sales Manager
Tooling Division

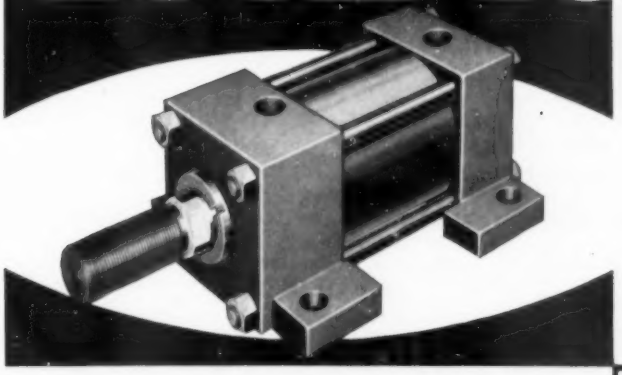
*P.S. We have it in epoxy too!!

furane plastics
INCORPORATED

4516 BRAZIL STREET • LOS ANGELES 39, CALIF.

FOR FURTHER NFORMATION, USE READER SERVICE CARD; INDICATE A-3-453-1

LOOK TO LOGAN



LOGAN SUPER-MATIC HYDRAULIC CYLINDERS ARE DESIGNED TO ASSURE PEAK PERFORMANCE ON ANY PRODUCTION JOB

MEMBER: *National Machine Tool Builders' Assn.; National Fluid Power Assn.*

Illustrated
Logan Super-Matic Hydraulic Cylinder

Logan Super-Matic hydraulic cylinders incorporate advanced design and functional features for a wider range of industrial requirements, greater economy. A broad selection of mountings, bore sizes and strokes. Standard size and heavy-duty piston rods are available, both male and female.

SEND FOR FREE "LOGAN CALCULATOR"

LOGANSPORT MACHINE CO., INC.
839 CENTER AVE., LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ Facts of Life
- ☐ 100-1 Air Cyls.
- ☐ 100-2 Mill-Type Air Cylinders
- ☐ 100-3 Air-Draulic Cylinders
- ☐ 100-4 Air Valves
- ☐ 100-5 Logan-square Cyls.
- ☐ 100-5-1 Ultra-mation Cyls.
- ☐ 51 Presses
- ☐ 62 Sure-Flow Pumps
- ☐ 200-1 Hyd. Power Units
- ☐ 200-2 Rotocast Hyd. Cyls.
- ☐ 200-3 750 Series Hyd. Cyls.
- ☐ 200-4 and 200-7 Hyd. Valves
- ☐ 200-6 Super-Matic Cyls.
- ☐ 70-1 Chucks
- ☐ ABC Booklet
- ☐ Circuit Rider

TO:
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-453-2

ASTE SILVER ANNIVERSARY CONVENTION TECHNICAL PAPERS AVAILABLE NOW!

MAIL YOUR ORDER TODAY

The following technical papers delivered at the Silver Anniversary Convention of the American Society of Tool Engineers, in Houston, March, 1957 are ready for immediate distribution.

Paper No.	*Title*
1	The 'Why' of Registration and the Benefits Accruing to Those Affected
2	Registration—Industry's Point of View
3	Labor Control Experience in Aircraft Repair
4	Some Economics Aspects of Machine Tool Selection
5	Project Vanguard—Launching the Man-Made Moon
6	Tool Engineering for Project Vanguard
7	Design for Machining High Temperature Alloys
8	Chip Breaking Characteristics of Titanium
9	Residual Stresses from Machining Operations
10	Stress and High Temperature in Grinding
11	Fundamentals and Application of Thread and Form Rolling
12	Another Revolutionary Process—Power Roll Forming
13	A Machinable, Heat Treatable and Weldable Cemented Carbide for Tooling Purposes
14	The Inchworm Motor
15	Special Machine Tools for the Oil Country
16	THREADS That Hold the STRING Together
*17	Background and Properties of Oxide Cutting Tools
*18	A Review of Published Russian Work
*19	Ceramic Tool Geometry and Preparation
*20	A Comparison of Workpiece Finish Produced by Ceramic and Carbide Cutting Tools
*21	Cutting Tool Temperatures
*22	Progress Report—Ceramic Cutting Tools Applied to Production Jobs
*23	Analysis of Variables in Ceramic Tool Cutting
*24	Industrial Application of Ceramic Tools
†29	What are Plastics?
†30	What Properties are Available in Plastics?
†31	The History of Plastic Tooling
†32	The Fabrication of Plastic Tools
†33	Tool Applications of Plastic Materials
†34	What are the Known Limitations of Plastic Tools?
†35	Can Plastic Tools be Repaired and Modified?
†36	Control of Physical Properties
41	Standardization and the Legal Eagles
42	Conception and Development of J. I. C. Standards
	This Group Sold as a Single Paper
*25, *26, *27, *28	Cemented Oxide Cutting Tools in Service; Experimental Machining with Ceramics; Ceramic Tools—The Challenge of Physical Properties; Ceramic Machining Developments
	This Group Sold as a Single Paper
†37, †38, †39, †40	Repair and Modification of Plastic Tools; Plastic Tooling for Small Parts; Experiences with Plastic Tooling in the Stamping Plant; Polyamide Resin Alloys in Practical Applications

---

ASTE Collected Papers, Dept. 3
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

MINIMUM ORDER—$1.00

A COMPLETE BOUND SET OF ALL THE ABOVE PAPERS IS NOW AVAILABLE TO
MEMBERS, $5.00 ☐ NONMEMBERS, 10.00 ☐

A BOUND SET OF ONLY THE PLASTIC SYMPOSIUM PAPERS IS AVAILABLE TO
MEMBERS, $3.00 ☐ NONMEMBERS, $6.00 ☐

A BOUND SET OF ONLY THE CERAMIC SYMPOSIUM PAPERS IS AVAILABLE TO
MEMBERS, $3.00 ☐ NONMEMBERS, $6.00 ☐

* All Ceramic Symposium papers are marked * for easy selection.
† All Plastic Symposium papers are marked † for easy selection.

Please send postpaid the individual *Silver Anniversary Meeting Papers* circled below at 50c each (for members)—$1.00 each (nonmembers)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 [25 26 27 28][1] 29 30 31 32 33 34 35 36 [37 38 39 40][2] 41 42

1. A four part panel on Ceramic Tools in Service, papers 25, 26, 27 and 28, sold as a single paper.
2. A four part panel on Plastic Tools in Service, papers 37, 38, 39, and 40, sold as a single paper.

Name .....

Address .....

.....

City ..... Zone ..... State .....

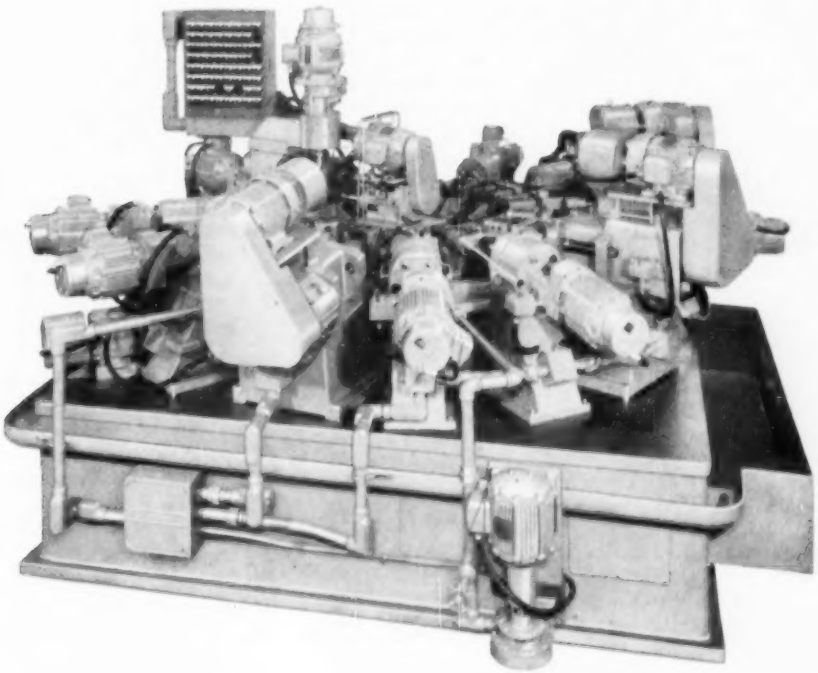
MEMBER ☐ CHAPTER NO. ..... NONMEMBER ☐

FULL PAYMENT MUST ACCOMPANY ALL ORDERS

Fifteen operations are performed on two different refrigerator compressor rotors with this R-J drilling, milling, and reaming machine employing R-J standard drill units and automatic index table.

CASE HISTORY
MACHINE NO. 1240

REHNBERG-JACOBSON



DELIVERS ON TIME

Order Placed:	10-4-56
Required Delivery:	1-30-57
Engineering Completed:	11-2-56
Machining Completed:	12-7-56
Sub-assemblies Completed:	12-14-56
Final Assembly Completed:	1-4-57
Final Testing Completed:	1-8-57
Customer Approved:	1-9-57
Machine Shipped:	1-16-57

Because of its size, the machine could not be shipped by rail and consequently had to move by special chartered transportation. It was timed to arrive at the customer's plant over the weekend of January 19 for the reason that a portion of the building had to be removed in order to get the machine into the plant.

Our service engineer arrived at the customer's plant January 22. After 7 days demonstration at the quoted production rate of 259 pieces per hour, the machine was accepted by the customer on January 31.

For prompt, efficient solution of your production problems, write, wire or phone Irving G. Jacobson, Sales Manager. Telephone Rockford 8-2461.

REHNBERG-JACOBSON MANUFACTURING CO., 2135 KISHWAUKEE ST., ROCKFORD, ILLINOIS

DESIGNING ENGINEERS, MANUFACTURERS, AND PRODUCTION CONSULTANTS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-455

Index of The Tool Engineer Advertisers

March 1957 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1956 ASTE Industrial Exposition

♦Subscriber to ASTE Data Sheet Service

A

♦ Accurate Bushing Co. ... 261
*Ace Drill Corp. ... 270
♦ Acme Industrial Co. ... 309
*Acme Tool Co. ... 390
*Adamas Carbide Corp. ... 319
Airborne Accessories Corp. ... 235
Alina Corp. ... 256
*Allegheny Ludlum Steel Corp. ... 294
Allen Mfg. Co. ... 411
♦*Allied Products Corp., Richard Brothers Punch Division ... 301
*American Brake Shoe Co., Denison Engineering Division ... 352
American Brass Co., The ... 345
♦*American Chain & Cable Co., Wilson Mechanical Instrument Division ... 257
*American Coldset Corp. ... 435
*American Drill Bushing Co. ... 13
*American Gage & Machine Co. ... 29
*American Machine & Foundry Co., AMF Tool Division ... 320
*American Pullmax Co., Inc. ... 208
*American SIP Corp. ... 228
American Society of Tool Engineers ... 432, 454
American Tool Works Co., The ... 12
♦*Ames, B. C., Co. ... 276
*Ampco Metal, Inc. ... 420
*Anderson, F. E., Oil Co. ... 245
Armstrong-Blum Mfg. Co. ... 242
*Armstrong Bros. Mfg. Co. ... 192
*Aro Equipment Corp., The ... 376
*Atlas Press Co., Clausing Division ... 314
Atrax Co., The ... 277
*Automation Devices, Inc., Perry Equipment & Eng. Co., Division ... 405
Avey Drilling Machine Co. ... 362-363
Aviation Developments, Inc. ... 236

B

B.S.A. Tools, Ltd. ... 404
Baird Machine Co. ... 48
*Bakelite Co., A Division of Union Carbide & Carbon Corp. ... 291
Balas Collet Mfg. Co. ... 460
Baldwin-Lima-Hamilton, Hamilton Division ... 366
Barber-Colman Co. ... 52-53
Barksdale Valves ... 418
*Barnes Drill Co. ... 44
Bath, Cyril, Co., The ... 214
Bath, John, Co., Inc. ... 371
Bellows Co., The ... 356
*Besly-Wells Corp ... 286-287
Bethlehem Steel Corp. ... 409
Black Drill Co. ... 336
*Blake, Edward, Co. ... 426
*Bliss, E. W., Co. ... 62-63, 335
Bodine Corp., The ... 346
Borg-Warner Corp., Rockford Clutch Division ... 190
Boston Gear Works ... 393
Bridgeport Brass Co. ... 379
♦*Bristol Co., The ... 328
♦*Brush Electronics Co. ... 434
*Bryant Gage & Spindle Division, Bryant Chucking Grinder Co. ... 203
♦*Buck Tool Co. ... 218
Bullard Co., The ... 357
*Burg Tool Mfg. Co. ... 188
Butterfield Division, Union Twist Drill Co. ... 297

C

Cadillac Gage Co. ... 329
Carborundum Co., The ... 369-370, 396
*Carborundum Co., The, Stupakoff Division ... 433
Card, S. W., Division, Union Twist Drill Co. ... 311
Cardinal Machine Co. ... 374
Carlton Machine Tool Co., The ... 400-401
*Carpenter Steel Co., The ... 64-65
*Carter Controls, Inc. ... 205
Central Safety Equipment Co. ... 440
*Cerro de Pasco Corp. ... 398
*Challenge Machinery Co. ... 437
♦ Chaso Tool Co. ... 408
Chicago-Latrobe ... 274
*Chicago Pneumatic Tool Co. ... 342-343
*Ciba Co., Inc. ... 429
Cincinnati Grinders, Inc., Cincinnati Milling Machine Co. ... 423
Cincinnati Milling Machine Co., Heald Machine Co., Subsidiary .. Inside Front Cover
Cincinnati Shaper Co. ... 34-35
*Clausing Division, The Atlas Press Co. ... 314
♦ Clearing Machine Corp., Division of U. S. Industries, Inc. ... 70
*Cleco Division, Reed Roller Bit Co. ... 219
Cleveland Crane & Engineering Co., The ... 442
*Cleveland Instrument Co., Inc. ... 204
Cleveland Twist Drill Co. ... 38
Coast Mfg. & Supply Co. ... 290
*Collins Microflat Co. ... 344
Colonial Broach & Machine Co. ... 299-300
Commando Tool Co. ... 444
Comtor Co. ... 440
Concentric Tool Corp. ... 328
Cone Automatic Machine Co. ... 443
Cone Automatic Machine Co., Pilot Division ... 66-67
Cosa Corp. ... 318
Coulter, James, Machine Co., The ... 430
Covel Mfg. Co. ... 308
*Crafts, Arthur A., Co., Inc. ... 246
*Crane Packing Co. ... 375
Cratex Mfg. Co. ... 425
Cross Co., The ... 24-25

*Crucible Steel Company of America 332
Crumpton, W. D., & Co. 263
*Cushman Chuck Co. 431

D

*Danly Machine Specialties, Inc. 36
*Dazor Mfg. Corp. 328
Dearborn Gage Co.,
Ellstrom Standards Division 51
Delpark Industrial Filtration 229
*Delta Power Tool Division,
Rockwell Mfg. Co. 317
*Denison Engineering Division,
American Brake Shoe Co. 352
Detroit Broach Co. 42-43
Detroit Die Set Corp. 303
*Detroit Milling Cutter Division,
Futurmill, Inc. 237
Detroit Mold Engineering Co. 417
*Detroit Power Screwdriver Co. 260
*Detroit Reamer & Tool Co. 249
*Detroit Stamping Co. 308
Devcon, Inc. 447
*DeVlieg Microbore Division,
DeVlieg Machine Co. 45
Diamonite Products Mfg. Co. 232
Die Techniques Publishers Division,
Falcon Engineering Co. 408
*DoALL Co. 382
Donley Products, Inc. 336
*Dow Chemical Co., The 446
Drillunit, Inc. 265
♦*Dumore Co., The 224
Dykem Co., The 336

E

Eastern Machine Screw Corp., The 202
*Eastman Kodak Co. 37, 193
Edlund Machinery Co. 289
Ehrhardt Tool & Machine Co. 353
*Electro-Mechano Co. 408
Ellstrom Standards Division,
Dearborn Gage Co. 51
*Elox Corporation of Michigan 68
Emerson Electric Mfg. Co. 211
*Engelberg-Huller Co., Inc. 248
*Erickson Tool Co. 410
Errington Mechanical Laboratories, Inc. 320
Ettco Tool Co., Inc. 348
Ex-Cell-O Corp. ..... Inside Back Cover, 295

F

Falcon Engineering Co.,
Die Techniques Publishers, Division 408
*Federal Products Corp. 14-15
*Fellows Gear Shaper Co. 323
*Firth-Sterling, Inc. 422
*Flick-Reedy Corp.,
Miller Fluid Power Division 298
Foote-Burt Co., The 302
Fonda, D. C., Gage Co. 264
*Furane Plastics, Inc. 453
*Futurmill, Inc.,
Detroit Milling Cutter Division 237

G

*Gaertner Scientific Corp. 263
*Gammons-Hoaglund Co. 344
♦ Gardner-Denver Corp.,
Keller Tool Division 412
♦ Gatco Rotary Bushing Co. 426
General America Transportation Corp.,
Parker-Kalon Division 436
*General Electric Co.,
Metallurgical Products Dept. 58-59
*General Industrial Diamond Co. 360
Gilman, Russell T., Co. 270
Gisholt Machine Co. 17-18-19-20
Goddard & Goddard 278
Gorton, George, Machine Co. 406
*Govro-Nelson Co. 336
Greaves Machine Tool Co. 215
Greenfield Tap & Die Corp. 333
♦ Greenfield Tap & Die Corp.,
Horton Chuck Division 334
Greenleaf Corp.,
Newcomer Products, Inc. 273
Greenlee Bros. & Co. 386
Grob, Inc. 426

H

Hamilton Division,
Baldwin-Lima-Hamilton 366
♦ Hanchett Magna-Lock Corp.,
Magna-Lock, Inc. 251
*Handy & Harman 414
*Hannifin Corp. 288, 325
*Hardinge Brothers, Inc. 4-5
♦ Hartford Special Machinery Co. 415
*Haynes Stellite Co., A Division of
Union Carbide & Carbon Corp. 380
Heald Machine Co., Subsidiary,
Cincinnati Milling Machine Co. .. Inside Front Cover
*Heinrich Tools, Inc. 254
*Heller Tool Co., Subsidiary,
Simonds Saw & Steel Co. 285, 340-341
♦*Horton Chuck Division,
Greenfield Tap & Die Corp. 334
Hypro Tool Co. 240

I

*Ideal Industries, Inc. 209
Industrial Filtration Co.,
Delpark Division 229
*Ingersoll-Rand Co. 258-259

J

♦ Jacobs Mfg. Co. 413
Jahn, B., Mfg. Co., The 250
*Jergens Tool Specialty Co. 408
Jersey Mfg. Co. 308
Jessop Steel Co. 351
*Jones & Lamson Machine Co. 450

K

Kearney & Trecker Corp. 222-223
♦ Keller Tool Division, Gardner-Denver Corp. 412
*Kennametal, Inc. 372-373
King Tester Corp. 320
Kingsbury Machine Tool Co. 321
Klingelhofer Machine Co. 60-61
Knight, W. B., Machinery Co. 271

L

*Lamina Dies & Tools, Inc. 221
*Landis Machine Co. 8-9

*Lapeer Mfg. Co. 191
Lapointe Machine Tool Co. 30-31, 212
Lavallee & Ide, Inc. 235
*Lee, K. O., Co. 344
Levin, Louis, & Son, Inc. 354
♦ Lincoln Electric Co. 402
*Lindberg Engineering Co. 399
Lipe-Rollway, Inc. 255
Lodge & Shipley, Inc. 50
♦*Logansport Machine Co., Inc. 453
*Lovejoy Tool Co. 354

M

*Mac-It Screw Division,
Strong-Carlisle-Hammond 390
Macklin Co. 337
♦ Magna-Lock, Inc.
Hanchett Magna-Lock Corp. 251
*Mall Tool Co., Division,
Remington Arms Co., Inc. 403
*Manhattan Rubber Division,
Raybestos-Manhattan, Inc. 54
*Marvel Engineering Co. 239
*Mayline Co. 440
McKay Machine Co. 305
*Mead Specialties, Inc. 419
*Metal Carbides Corp. 322
Metal Treating Institute 16
*Metallurgical Products Department,
General Electric Co. 58-59
♦ Meyers, W. F., Co. 360
Michigan Tool Co. 55-56
Micro-Positioner Corp., The 266
Middlestadt Machine Co. 408
*Milford Rivet & Machine Co., The 243
*Miller Fluid Power Division,
Flick-Reedy Corp. 298
Miller, Harry, Corp. 359
Milne, A., & Co. 445
*Mohawk Tools, Inc. 338
Moore Special Tool Co. 244
*Morse, H. E., Co. 326
Morse Twist Drill & Machine Co.
Subs. Van Norman Industries, Inc. 32-33

N

National Acme Co., The 427
National Automatic Tool Co., Inc. 306-307
*National Broach & Machine Co. 368
National Tool Co. 421
New Britain Machine Co., The 292-293
Newcomer Products, Greenleaf Corp. 273
New York Twist Drill Co. 246
Niagara Machine & Tool Works 46-47
Nice Ball Bearing Co. 313
*Nikon, Inc. 284
Nilson, A. H., Machine Co., The 238
Norton Co.,
Abrasive Grinding Wheel Division 22-23
Novi Tool & Machine Co. 360

O

*Oakite Products, Inc. 389
*Ohio Crankshaft Co., Inc. 283
♦ Ohio Knife Co. 358
*O. K. Tool Co., Inc. 385
♦*Ortman-Miller Machine Co. 367
*Osborn Mfg. Co. 394

P

Parker-Kalon Corp., Division,
General American Transportation Corp. 436
Parker-Majestic, Inc. 361
Parkwood Laminates, Inc. 393
*Perry Equipment & Engineering Co., Division
Automation Devices, Inc. 405
*Petz-Emery, Inc. 290
Pilot Division, Cone Automatic Machine Co. 66-67
*Pines Engineering Co., Inc. 324
Pioneer Aluminum, Inc. 210
Pioneer Tool & Eng. Co. 378
Pipe Machinery Co. 339
Pittsburgh Tool Steel Wire Co. 49
Pope Machinery Corp. 11
Porter, H. K., Co.,
Vulcan Crucible Division 216
Potter & Johnson Co., Division
Pratt & Whitney Co., Inc. 281
Pratt & Whitney Co., Inc. 206-207, 226-227, 268-269
*Precision Tool & Mfg. Co. 218
*Producto Machine Co., The 39

R

*R and L Tools, Inc. 355
*Raybestos-Manhattan, Inc.,
Manhattan Rubber Division 54
*Ready Tool Co. 230
Reed Rolled Thread Die Co. 247
*Reed Roller Bit Co.,
Cleco Division 219
Rehnberg-Jacobson Co. 455
Reliant Industries, Inc. 354
*Remington Arms Co., Inc.,
Mall Tool Co., Division 403
♦*Richard Brothers Punch Division,
Allied Products Corp. 301
*Robbins, Omer E., Co. 262
Rockford Clutch Division,
Borg-Warner Corp. 190
*Rockwell Mfg. Co.,
Delta Power Tool Division 317
Roto-Finish Co. 197
*Rotor Tool Co., The 350
*Russell, Holbrook & Henderson, Inc. 327
Ruthman Machinery Co. 256
*Ryerson, Jos. T., & Son, Inc. 72

S

♦ S & E Machine Products, Inc. 213
Sandvik Coromant Division,
Sandvik Steel, Inc. 201
Scherr, Geo., Co. 296
*Schrader's, A., Son 449
♦*Scully-Jones & Co. 439
*Seibert & Sons, Inc. 395
Seneca Falls Machine Co. 312
♦*Service Machine Co. 275
Sheffield Corp., The 349
*Sheldon Machine Co. 272
*Shell Oil Co. 21
*Sheppard, Stanley 296, 374
Sidney Machine Tool Co. 40
Simmons, W. T., Co. 374
*Simonds Abrasive Co. 377
*Simonds Saw & Steel Co. 365
*Simonds Saw & Steel Co.
Heller Tool Co., Subsidiary 285, 340-341
*Simplex Corp. 252

Sinclair Refining Co. 315
*Size Control Co., Industrial Division,
American Gage & Machine Co. 29
*Skinner Chuck Co., The 384
Smit, J. K., & Sons, Inc. 231
Snow Mfg. Co. 424
Snyder Tool & Eng. Co. 6-7
Sossner Tap & Tool Co. 392
South Bend Lathe Works 284
*S-P Mfg. Corp. 225
Splinemaster Products, Inc. 280
*Standard Gage Co., Inc. 10
Standard-Modern Tool Co., Inc. 451
*Standard Parts Co. 228
*Standard Pressed Steel Co. 316
Standard Tool Co. 381
Staples Tool Co. 416
*Starrett, L. S., Co., The 383
Stau, E. H., Co. 197
*Strong, Carlisle, Hammond Co.,
Mac-It Screw Division 390
Stuart, D. A., Oil Co., Ltd. 330-331
*Stupakoff Division,
The Carborundum Co. 433
Sturtevant, P. A., Co. 290
Sun Oil Co. 2
*Super Tool Co.,
Subs., Van Norman Industries, Inc. 397
*Superior Steel Products Corp. 441

T

*Taylor Dynamometer & Machine Co. 273
Thomson Industries, Inc. 438
Threadwell Tap & Die Co. 69
Tietzmann Tool Corp. 418
Timken Roller Bearing Co. 391
*Tomkins-Johnson Co. 200

U

Uddeholm Company of America, Inc. 428
*Union Carbide & Carbon Corp.,
Bakelite Co., A Division 291
Haynes Stellite Co., A Division 380
Union Twist Drill Co.,
Butterfield Division 297
S. W. Card Division 311
Union Division 347
U. S. Drill Head Co. 364
U. S. Industries, Inc.,
Clearing Machine Corp., Division 70
*U. S. Rubber Co. 57, 304
*U. S. Tool Co. 310
Universal Engineering Co. 41

V

Vaill Engineering Co. 284
*Valenite Metals Corp. 387-388
*Van Keuren Co. 282
*Van Norman Industries, Inc.,
Morse Twist Drill & Machine Co., Subsidiary ..32-33
Super Tool Co., Subsidiary 397
*Vascoloy-Ramet Mfg. Corp. 194
Verson AllSteel Press Co. ..... Back Cover
Vulcan Crucible Steel Division,
H. K. Porter Co. 216
*Vulcan Tool Co. 426

W

*Waldes Kohinoor, Inc. 407
*Wales-Strippit Co. 196
*Walsh Press & Die Co., Industrial Division,
American Gage & Machine Co. 29
Ward Machinery Co. 390
*Warner & Swasey Co. 26-27-28
*Webber Gage Co. 198-199
*Wells Mfg. Co. 418
Wendt-Sonis Mfg. Co. 220
Westinghouse Electric Corp. 448
Wiedemann Machine Co. 452
*Willey's Carbide Tool Co. 217
*Wilson Mechanical Instrument Division,
American Chain & Cable Co. 257
*Wilton Tool Co. 202
*Wisconsin Drill Head Co. 279
*Woodworth, N. A., Co. 275

Y

Yoder Co., The 251

Z

Ziegler, W. M., Tool Co. 296

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN
Austin G. Cragg
Frank Baldwin
400 Madison Ave.
New York 17, N.Y.
PLaza 9-4018

OHIO
Richard E. Cleary
15515 Detroit Ave.
Cleveland 7, Ohio
LAkewood 1-7125

CENTRAL
Clarence T. Etter
R. Alan Cobleigh
10700 Puritan Ave.
Detroit 38, Mich.
UNiversity 4-7300

WESTERN
Stanley F. Girard
Room 217
612 North Michigan Ave.
Chicago 11, Ill.
Michigan 2-4465

PACIFIC COAST
Robert E. Ahrensdorf
5720 Wilshire Blvd.
Los Angeles 36, Calif.
WEbster 8-3881

every **BENCO** feed finger
is tested on the stock
it is designed to feed...

therefore

BENCO *guarantees* **satisfactory operation in your machines**

BENCO PUSHERS

Benco Pushers and Feed Fingers are made of oil hardened, non-warping tool steel heat treated by precision methods. As a result each point, from the thread to the bearing area, has the proper degree of hardness while the central section is spring tensioned.

It's this combination of accurate tempering and tension that gives every Benco Pusher and Feed Finger its longer life and superior performance. Each one is rigidly inspected and tested before it leaves the plant.

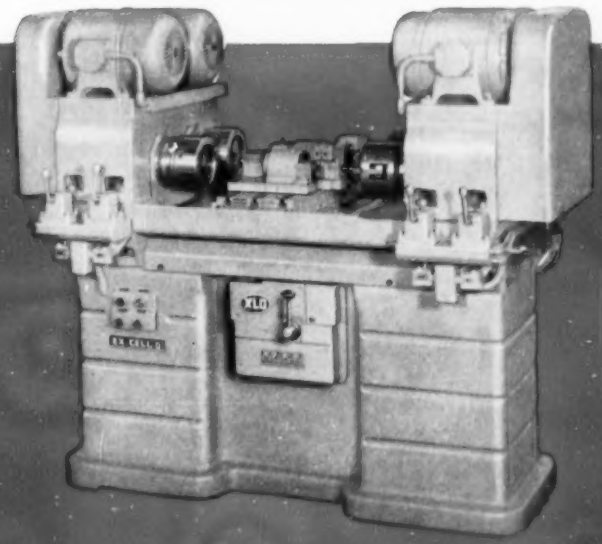
Benco makes the most complete line of Feed Fingers and Master Pushers. Each provides the maximum production economies when properly used... regardless of the type or shape of stock or machine you operate. Standardize on Benco for best results.

Conventional Pusher | Heavy Duty Pusher | Squirrel Cage Pusher | "Multi-Split" Feed Finger | Master Pusher

BENCO **COLLET MANUFACTURING CO.**
Cleveland 14, Ohio

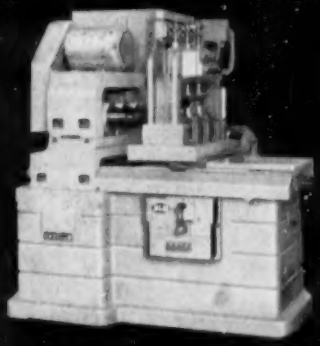
Maximum Production Speeds at Low Cost

WITH EX-CELL-O PRECISION BORING MACHINES

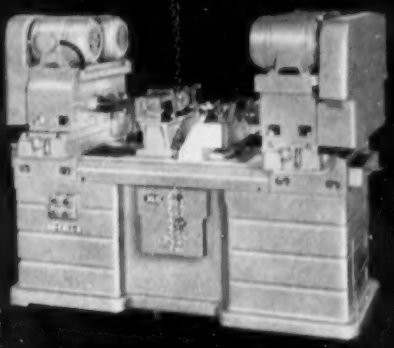


STYLE 1212-B. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production.

STYLE 2112-B. Single-end model for work pieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of work cycle.



STYLE 112-D. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.



STYLE 17-A. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be tooled for a wide range of production jobs.

These versatile Ex-Cell-O Precision Boring Machines bore, turn, face, counterbore, chamfer and groove.

Whichever model fits your production requirements, you'll find this large variety of precision operations will lower your costs—increase your profits.

All Standard Ex-Cell-O Precision Boring Machines can be equipped for work handling and ejecting operations, thus providing fast, automatic production at minimum cost.

Contact your local Ex-Cell-O representative who will provide all the facts about these machines, or write to Ex-Cell-O for a precision boring catalog.

XLO

EX-CELL-O FOR PRECISION

57-1

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

WORLD'S LARGEST

Mechanical Double Action Press . . . by

This 2500 ton capacity mechanical double action press weighs over 1,000,000 pounds, has a bed and ram area of 90″ (F-B) by 208″ (R-L) . . . another example of the design and engineering leadership that makes Verson first in presses.

VERSON ALLSTEEL PRESS CO.
Chicago and Dallas